



RPC 2026
RIO DE JANEIRO

Summary Talk

RPC Conference 2026

Friday, September 18 2026

João Pedro Gomes Pinheiro
Rio de Janeiro State University

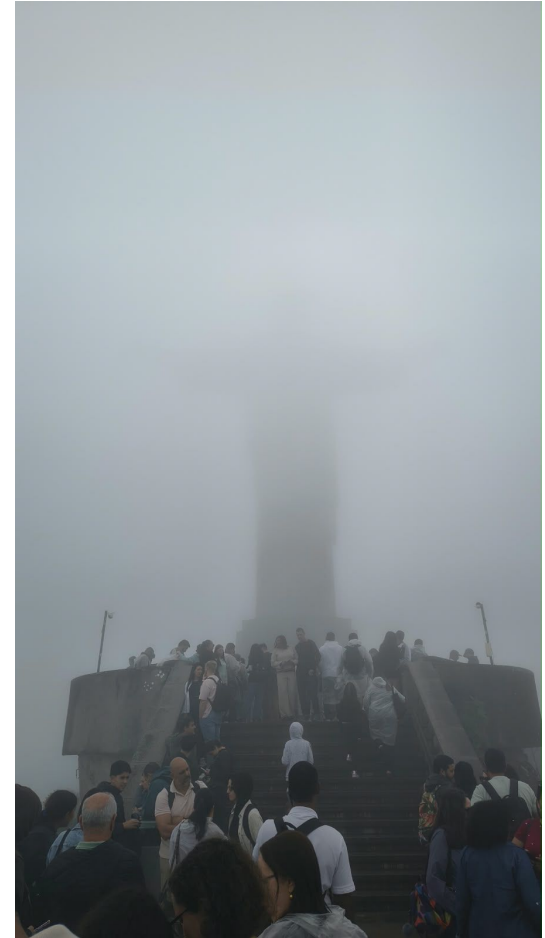
Introduction



Introduction



Introduction



Outreach activity



October 10 2026

Outreach activity sponsored by the RPC Conference with 30 high school students and teachers from Bangu School - Rio de Janeiro

Outreach activity



Outreach activity



Outreach activity



Opening Ceremony



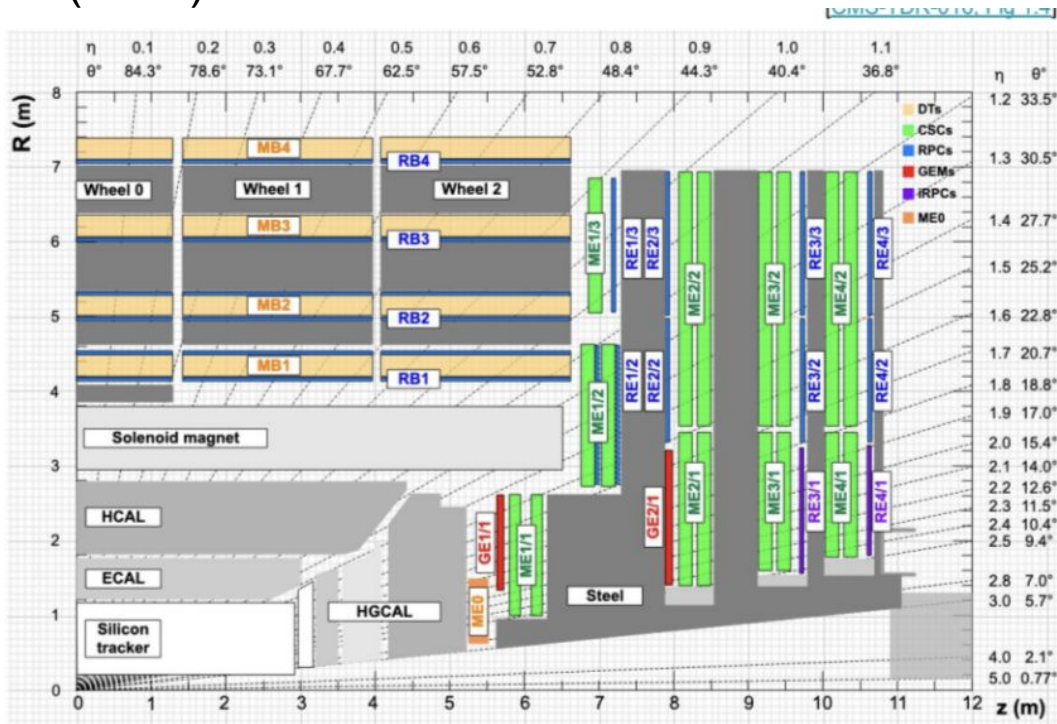
RPCs in High Energy Physics Experiments @ LHC

The Compact Muon Solenoid (CMS)

Present system: 1056 double-gap RPC chambers, with two 2 mm gas gaps

Phase-2 iRPC upgrade: 72 double-gap iRPC chambers, with two 1.4 mm gaps, extending the coverage

Status: 36 final iRPCs are already installed in RE-3/1 and RE-4/1 and operated during Run 3; the remaining 36 are ready for installation in RE+3/1 and RE+4/1.



An R-z cross section of a quadrant of the CMS detector, including the Phase-2 upgrades that increase the η range to 2.4 for RPCs and 2.8 for GEMs.

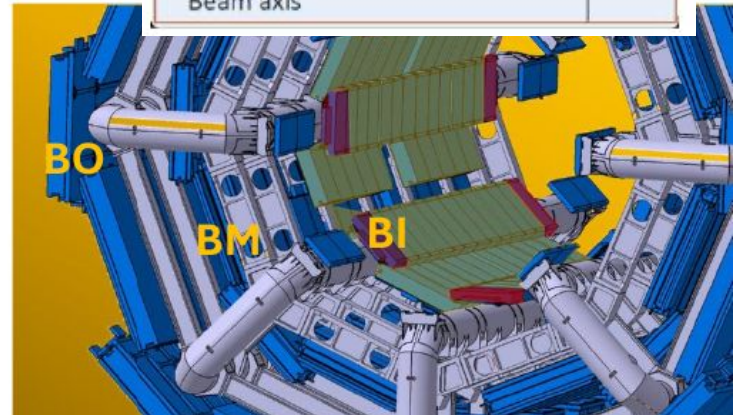
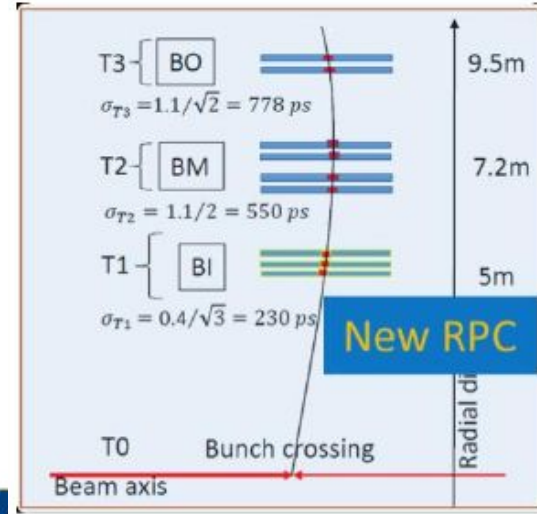
RPCs in High Energy Physics Experiments @ LHC

A Toroidal LHC Apparatus (ATLAS)

Present barrel RPC system (BM + BO): **~3,700 single-gap gas volumes (2 mm)**, arranged in two BM doublets and one BO doublet, providing six detection layers

Phase-2 technology already in ATLAS: 16 BIS78 next-generation RPC chambers were installed during LS2 as a pilot; the new chambers use **three independent 1 mm gaps**

Phase-2 upgrade: **306 RPC triplets** (918 of 1 mm gas gaps) planned for the Barrel Inner region, increasing the number of detection layers from 6 to 9



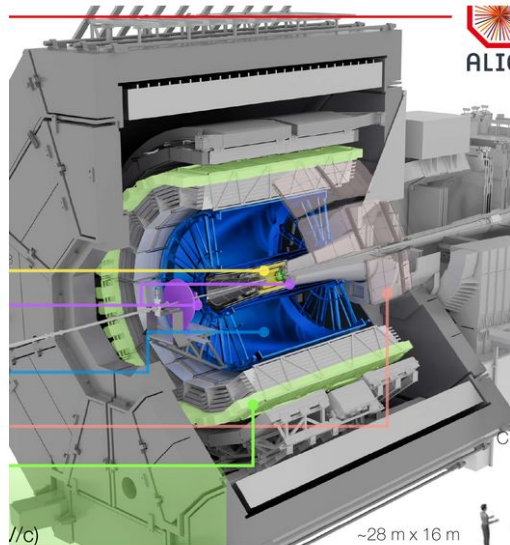
RPCs in High Energy Physics Experiments @ LHC

A Large Ion Collider Experiment (ALICE)

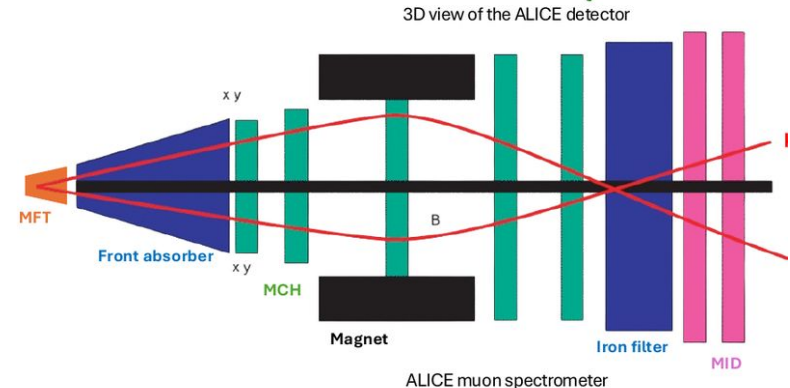
TOF — central barrel: 1593 MRPC strips, each with **10 gas gaps** arranged as **two stacks × five 250 μm gaps**, covering $|\eta| < 0.9$.

MID — forward muon spectrometer: 72 single-gap RPC chambers, arranged in **4 planes**, each with a **2 mm gas gap**, downstream of the iron filter.

TOF — central barrel



MID — forward muon spectrometer



Plenaries



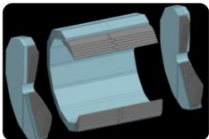
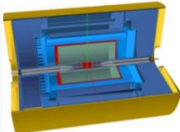
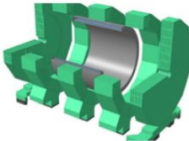
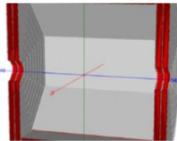
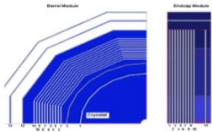
Satellite Seminars



Plenaries: FCC-ee: The Role of the Muon System

Riccardo Farinelli

FCC-ee muon systems are being designed for efficient muon identification and background rejection, with some concepts also targeting standalone tracking and long-lived-particle signatures

	AGORA	ALFA	ALLEGRO	CLD	IDEA	ILD
						
Vertex	Si	Si	MAPS	Si	MAPS	Si
Tracker	TPC	Full Si	DHC / Straw / SciFi	Full Si	Drift Chamber	Si+TPC
ECAL	Crystal	Si-W	Liquid Argon	Si-W	Crystals	Si-W
HCAL	Scint. sampling	Scint. / RPC	Scint. sampling	Scint. sampling	Fibre DR	Scint. / RPC
Muon	Scint.	Scint. / RPC	Scint. /MM / DT / RPC	RPC	μ -RWELL	Scint. / RPC
PID	tracker	ARC (?)	tracker	ARC (?)	tracker	tracker
B-field	2 T	2 T	2 T	2 T	2 T (3 T)	2 T

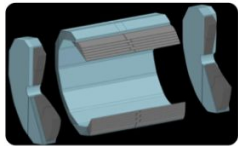
Plenaries: FCC-ee: The Role of the Muon System

Riccardo Farinelli



RPCs are considered in four of the six FCC-ee detector concepts for muon or calorimeter systems, with future R&D focused on performance and near-zero greenhouse-gas emissions

AGORA



Tech: plastic scintillator strips

Layout: 6 layers in iron yoke

Purpose: tagging muon system

ALFA

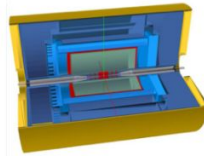


Tech: RPC or Scint. under discussion, possibly same HCAL

Layout: under discussion

Purpose: tagging muon system

ALLEGRO

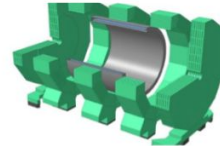


Tech: Squared drift tubes and Scintillator strips or Micromegas or Bigap RPCs

Layout: under discussion

Purpose: both tagging muon system and tracking muon system are considered

CLD

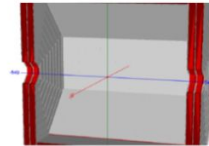


Tech: RPCs with 30x30 mm² cells.

Layout: 6 equidistant layers embedded in yoke slots. and 1 extra layer behind solenoid as tail-catcher.

Purpose: high granularity tagging and calorimetry support.

IDEA

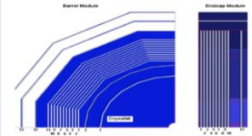


Tech: 50x50 cm² μ -RWELL chambers with 1.2 mm strip pitch

Layout: 4 stations interleaved with 30/50 cm iron yoke

Purpose: standalone tracking muon system for LLP

ILD



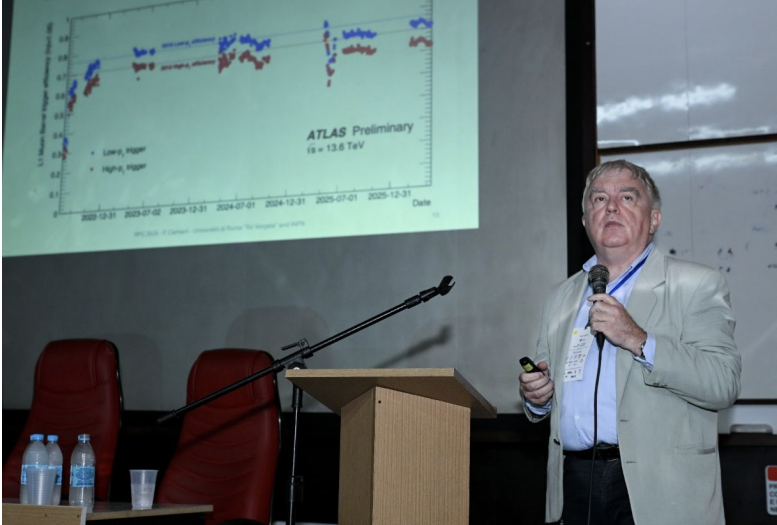
Tech: Scintillators (SiPM/WLS) or X-Y RPCs, possibly same HCAL

Layout: 14 active layers in barrel, 12 layers in endcap in iron yoke

Purpose: Robust tagging and 2D reconstruction

HEP Performance

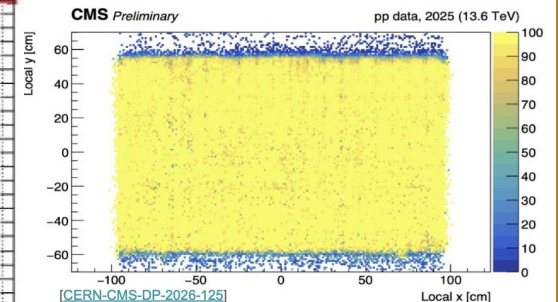
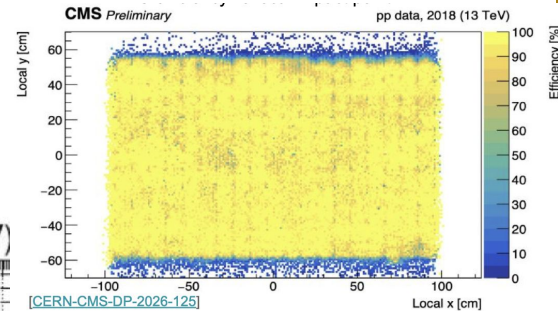
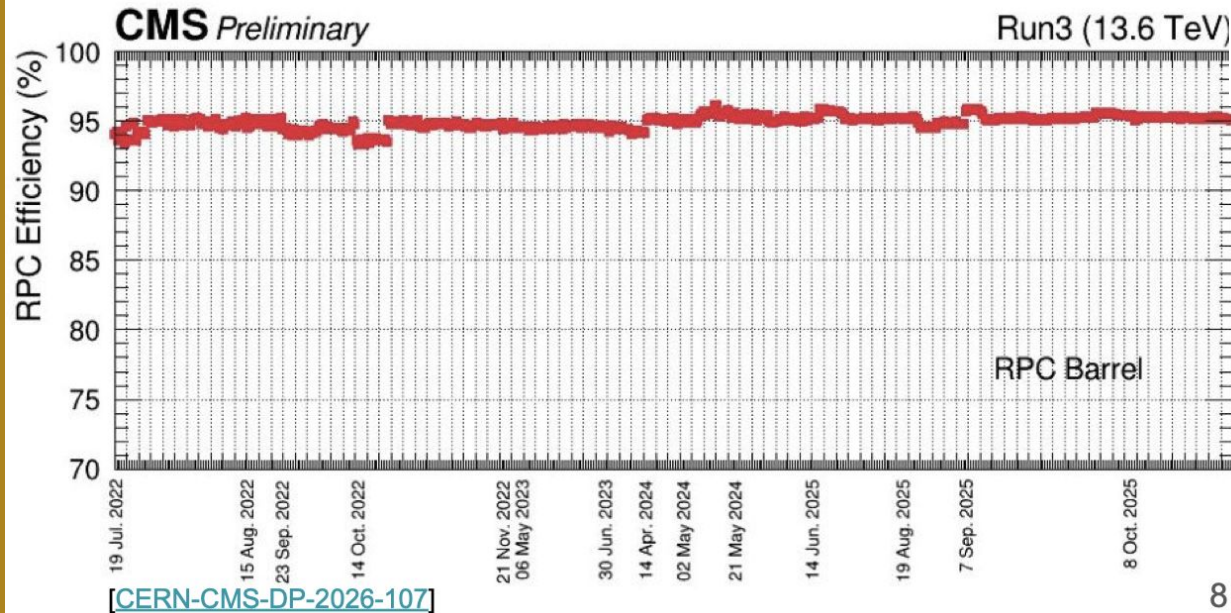
This session covers RPC and MRPC performance in high-energy physics experiments, from efficiency and timing to triggering, long-term stability and future detector requirements



HEP Performance: **CMS RPC performance**

Andres Cabrera on behalf of the CMS Collaboration

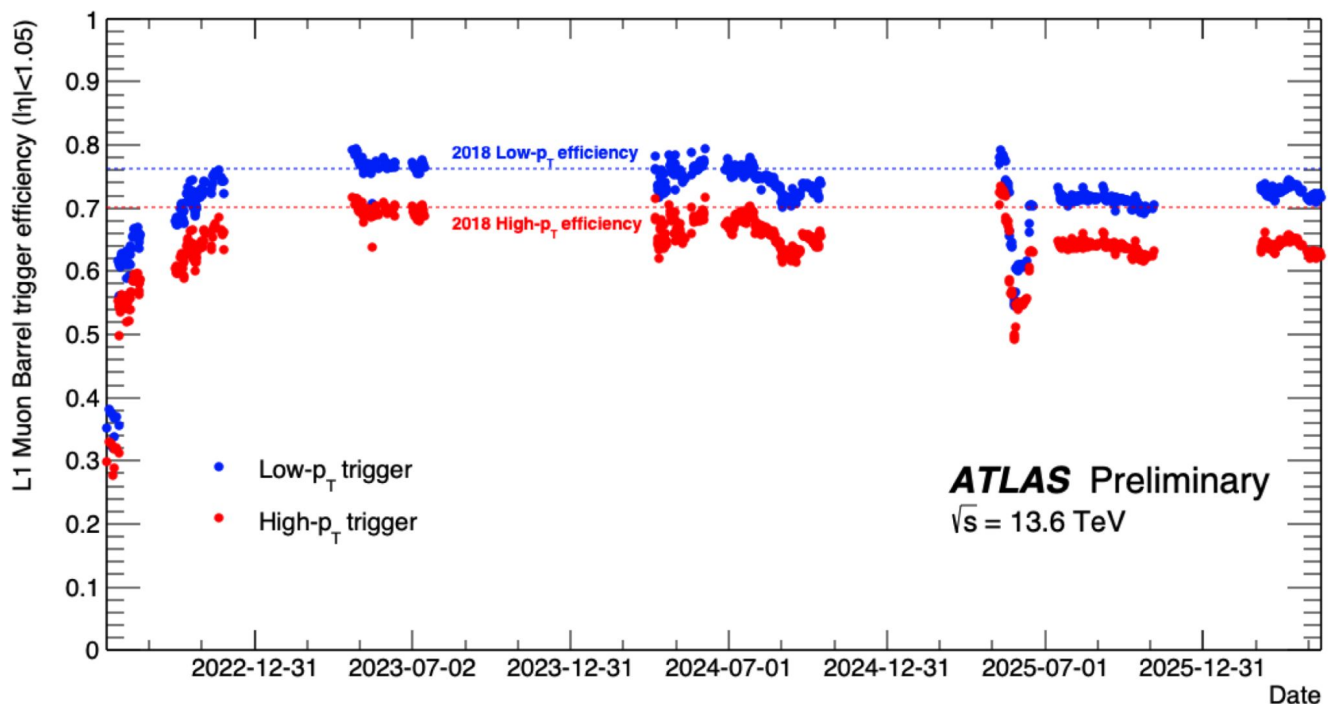
CMS RPCs maintained over 95% efficiency in Run 3, with gas-leak repairs restoring affected chambers and readout upgrades underway



HEP Performance: **ATLAS RPC performance**

Paolo Camarri on behalf of the ATLAS Collaboration

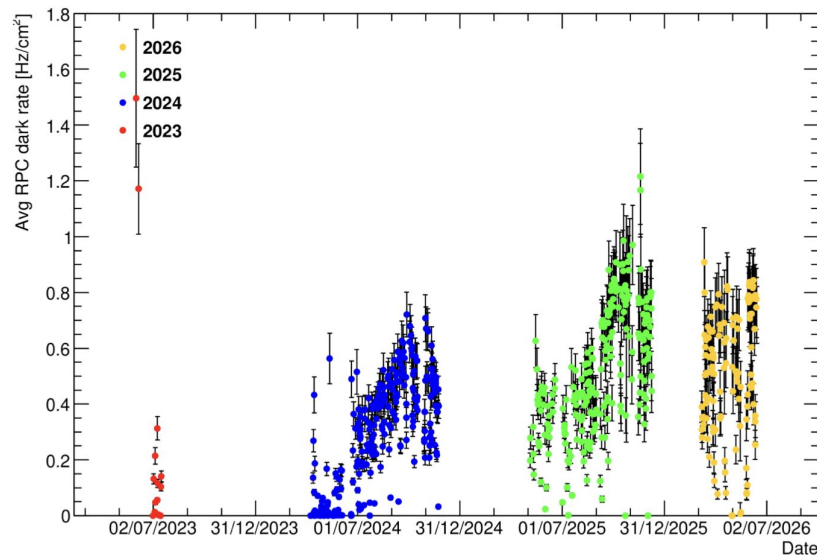
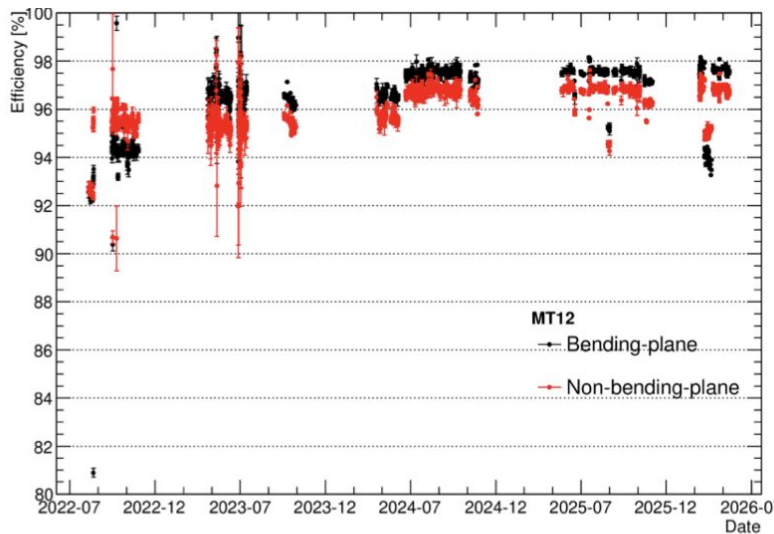
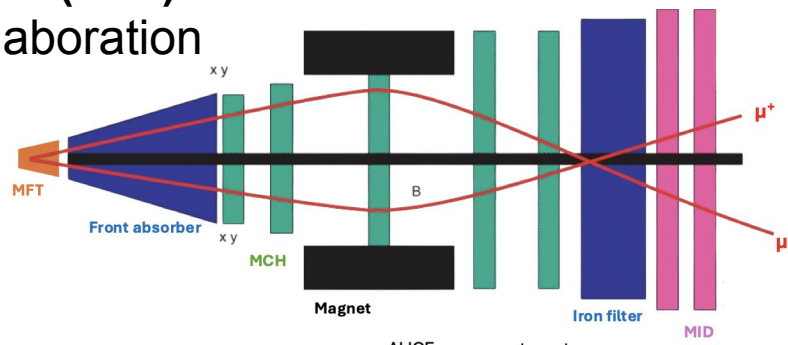
ATLAS maintained stable muon-trigger performance while addressing gas leaks in the existing RPC system



HEP Performance: **ALICE Muon Identifier (MID)**

Luca Quaglia on behalf of the ALICE Collaboration

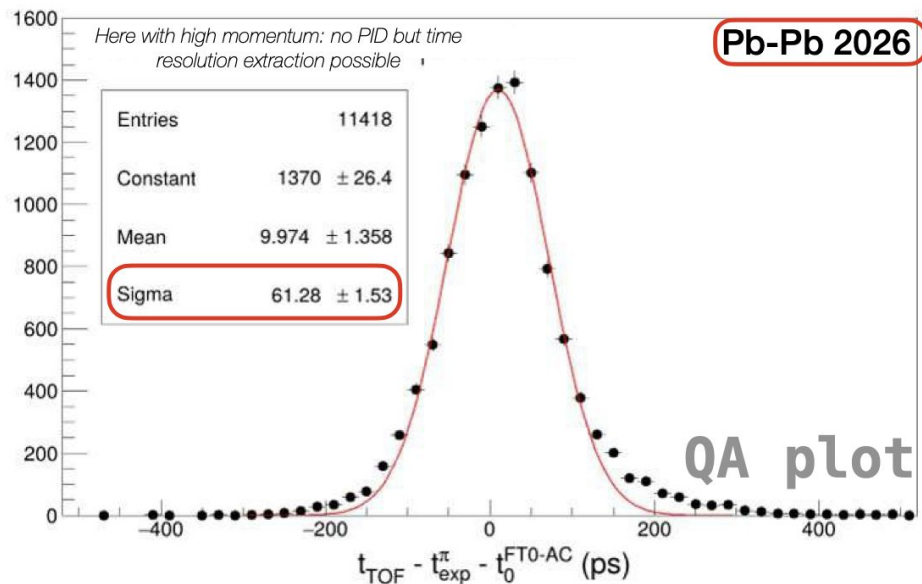
The new front-end electronics (FEERIC) for MID in Run 3 upgrade reduced accumulated charge per luminosity while maintaining RPC efficiencies above 96%



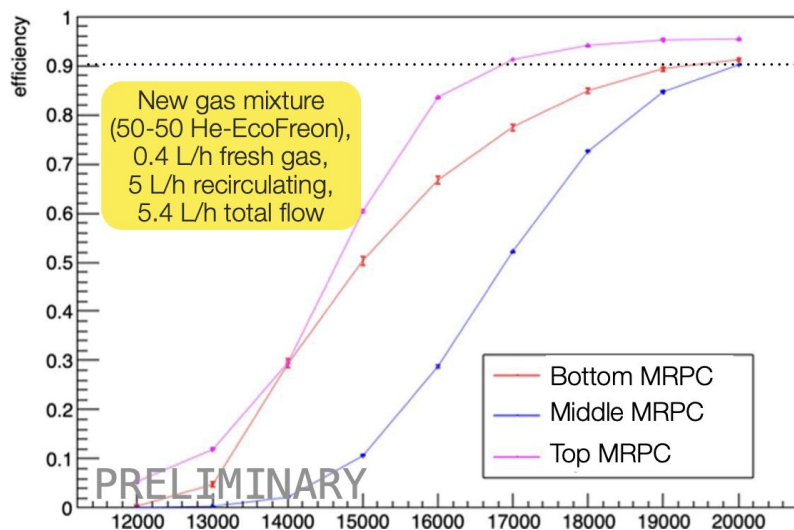
HEP Performance: **ALICE TOF** and **EEE**

Bianca Sabiu on behalf of the ALICE and EEE Collaboration

ALICE TOF maintains approximately 60 ps time resolution after more than 15 years of operation, with no significant ageing observed.



EEE telescopes are transitioning to a lower-impact gas mixture, while preliminary gas-recirculation tests achieved over 90% efficiency with 93% of the gas recirculated.



HEP Performance: **CMS iRPC back-end electronics**

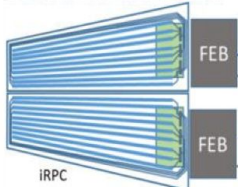
Canming Li on behalf of the CMS Collaboration

The iRPC back-end prototype achieved successful synchronization with the CMS Global Trigger and stable data-taking during LHC collisions.

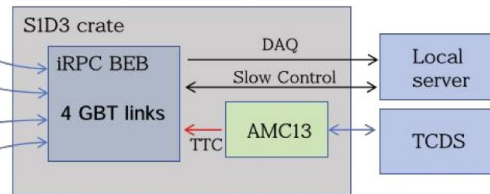
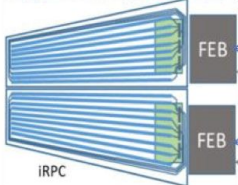
UXC(Underground Experimental Cavern)

USC(Underground Service Cavern)

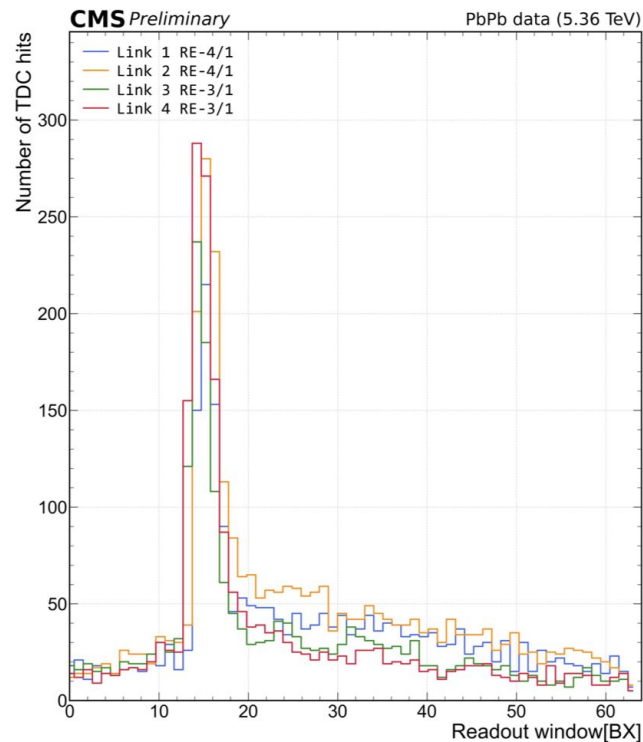
RE3/1 chamber13



RE4/1 chamber13



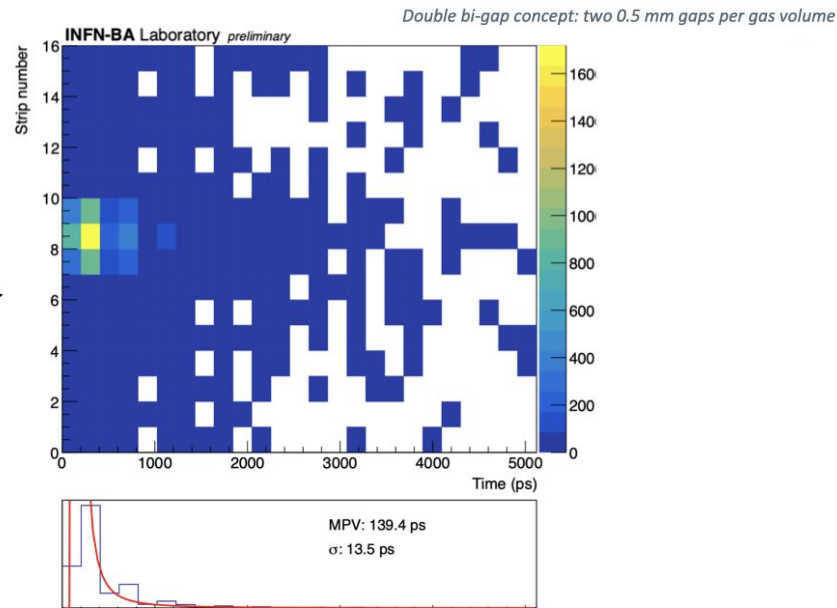
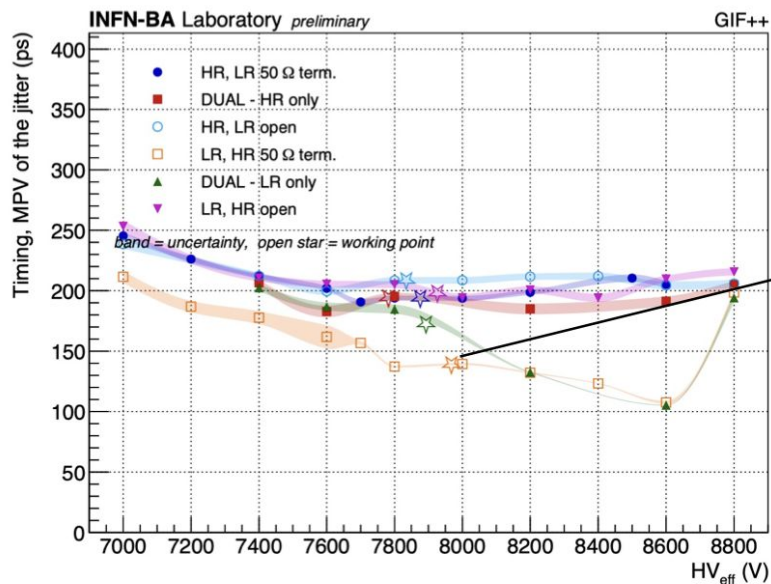
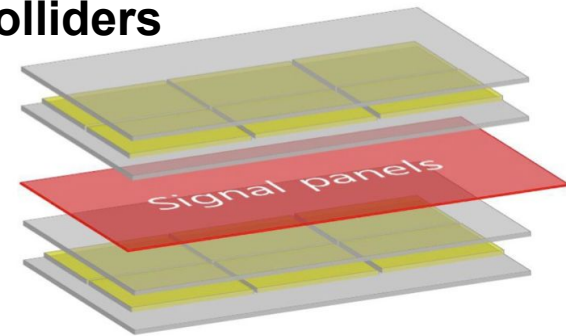
AMC13 — Advanced Mezzanine Card 13
TCDS — Timing and Control Distribution



HEP Performance: Thin-glass RPCs for future colliders

Dayron Ramos

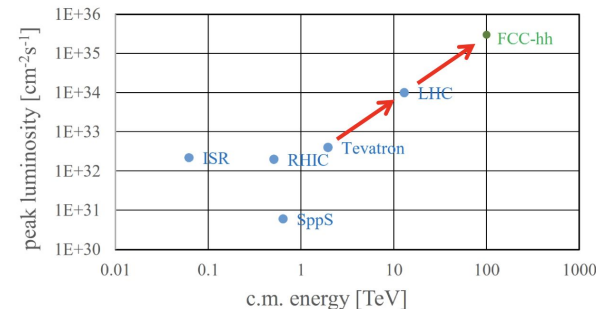
Thin-glass RPCs achieved timing down to 139 ps, while rate tests identified improvements still needed for future collider operation



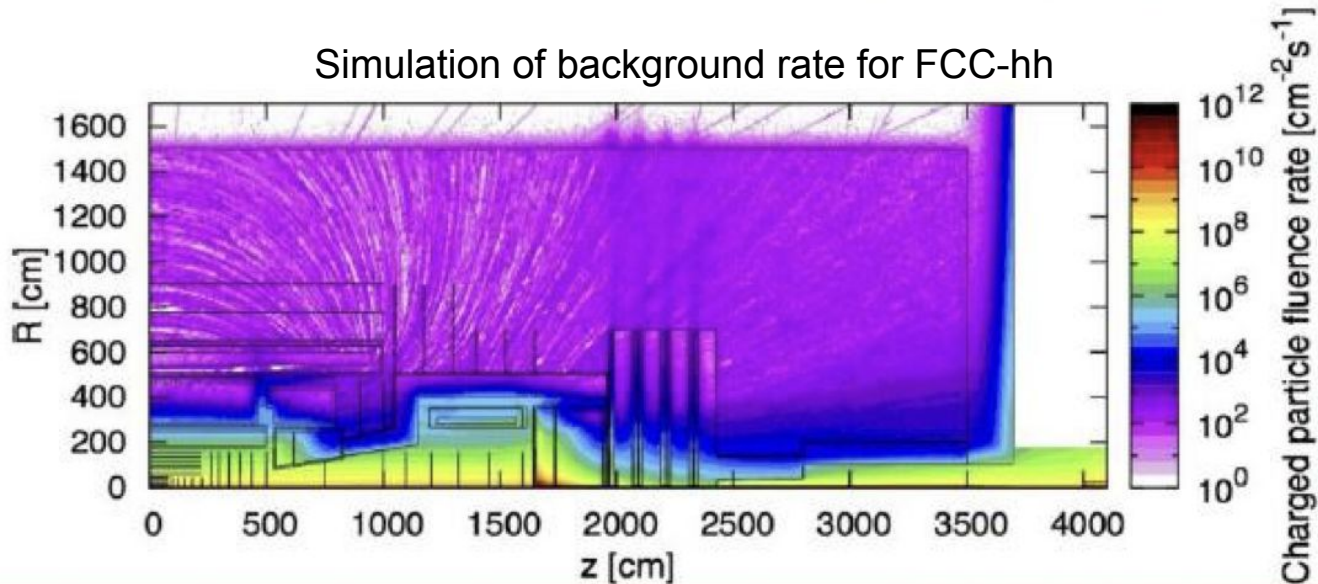
HEP Performance: **RPCs from HL-LHC to FCC**

Paolo Camarri

FCC-ee emphasizes precise muon identification, while FCC-hh will require RPCs with greater rate capability, faster electronics and sustainable gases



Simulation of background rate for FCC-hh



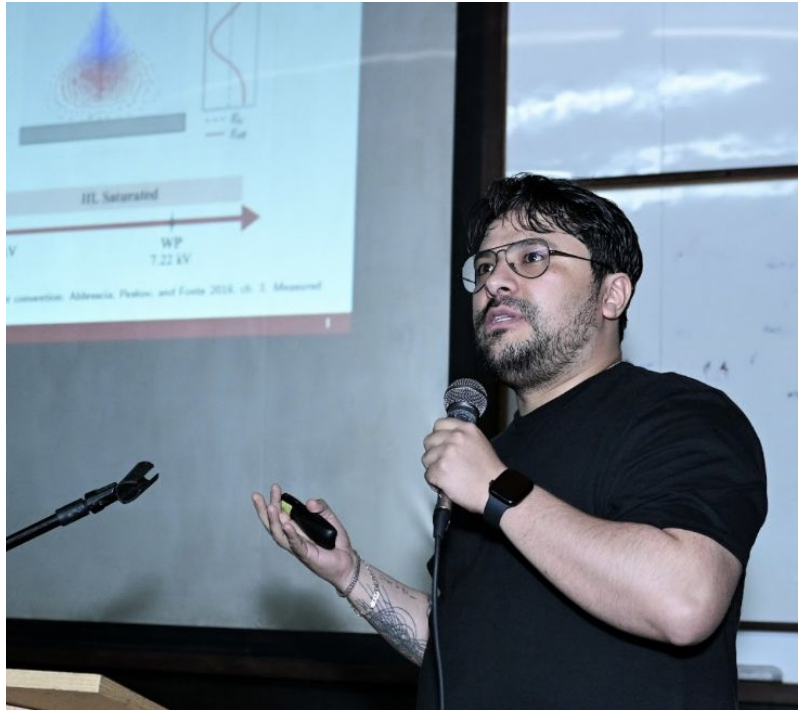
HEP Performance



RPCs continue to deliver reliable performance at the LHC, while new electronics and detector designs are pushing their capabilities towards HiLumi-LHC and future colliders

Physics and Simulation

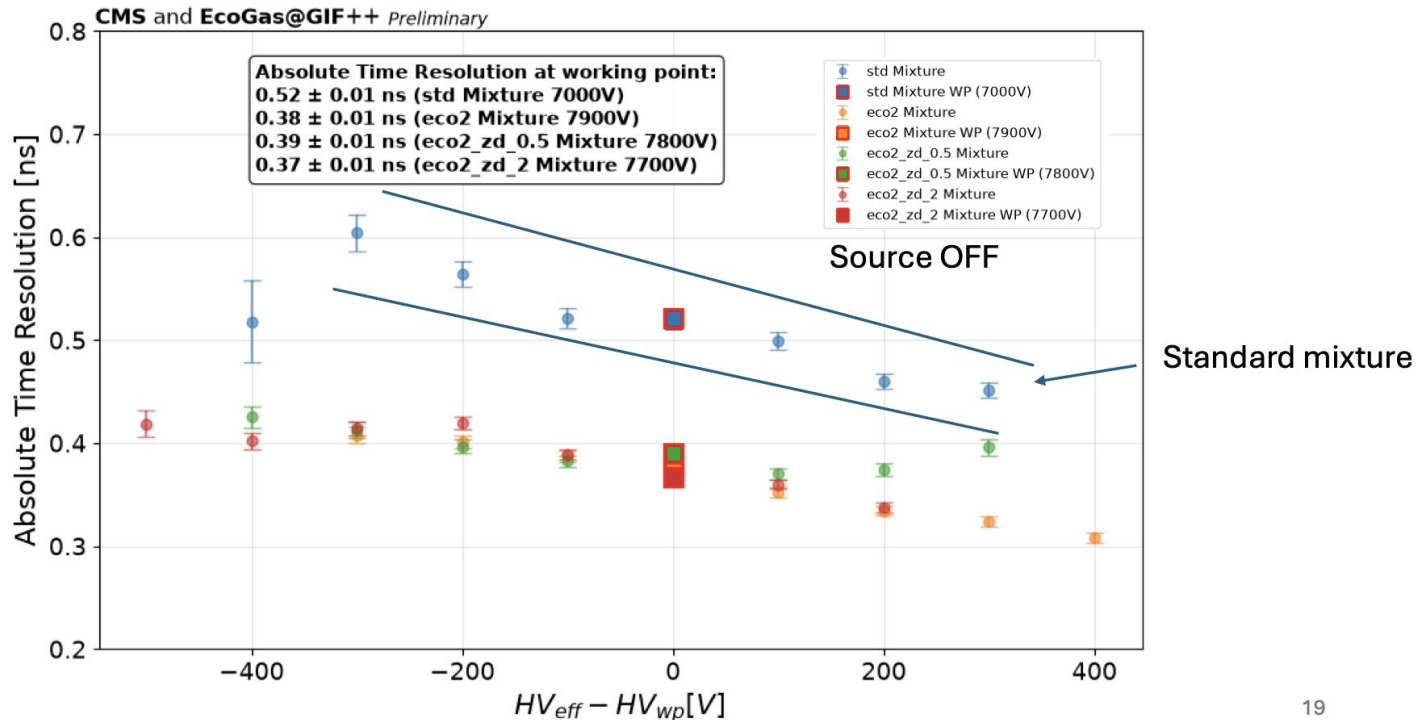
This session explores the physics behind RPC operation, including avalanche development, signal formation, electrode properties and simulations of new detector designs



Physics and Simulation: **Signal Analysis and Machine Learning**

Dalmo Dalto on behalf of the CMS Collaboration

Eco-friendly mixtures produced faster iRPC signals but larger charges and clusters, while machine learning identified additional waveform patterns



Physics and Simulation: **Understanding Ionization-Rate Discrepancies**

Dario Stocco

Signal propagation through the readout electronics can distort ionization-rate measurements in thin-gap RPCs, partly explaining their disagreement with independent gas measurements

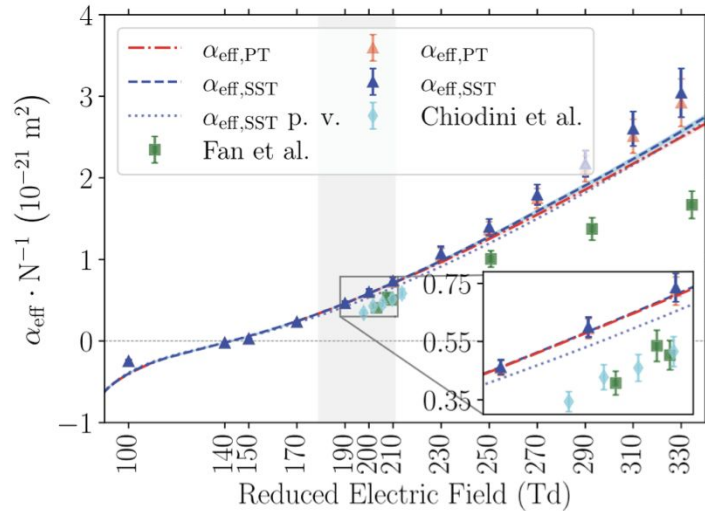
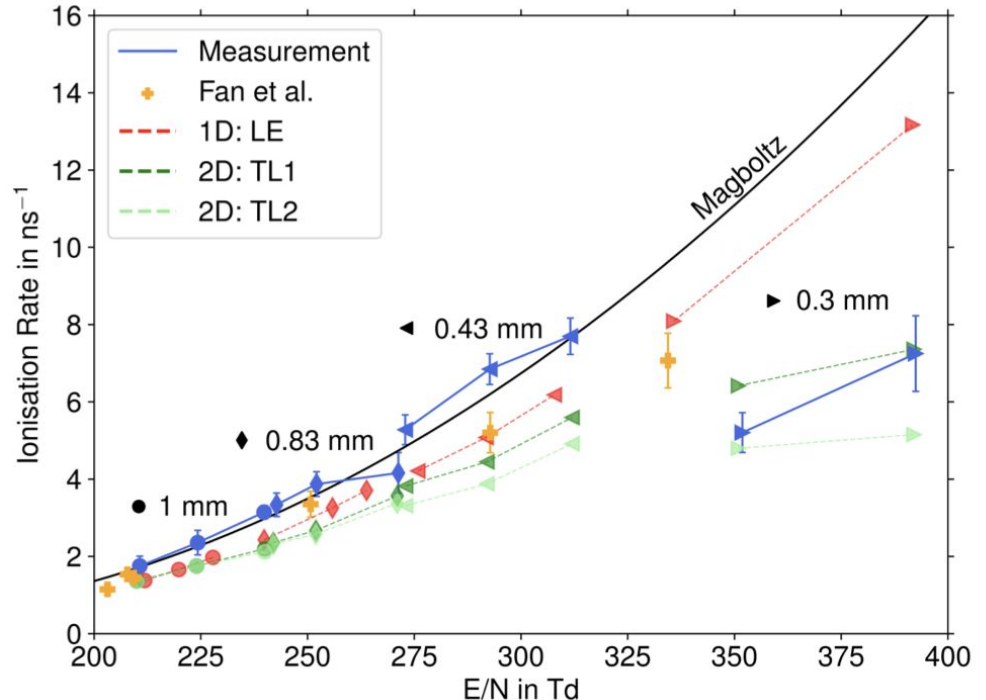


Figure: Ionization coefficient measured on the pulsed Townsend setup (blue) compared to literature values measured using RPCs (lightblue and green) [SMF24].

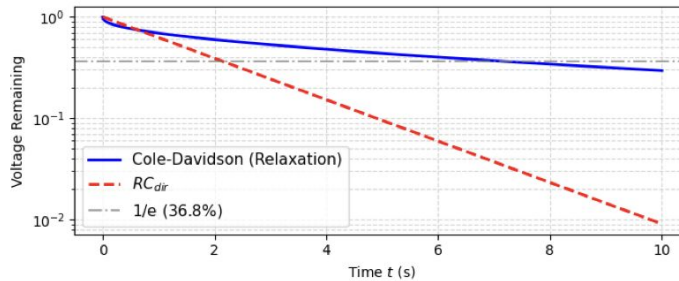


Physics and Simulation: **Resistive Materials Beyond the RC Model**

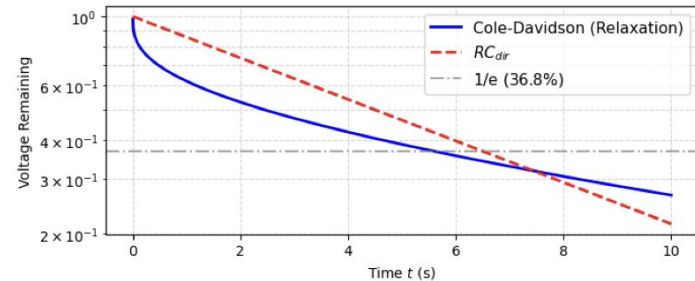
Xandre Álvarez González

Measurements reveal how RPC electrode materials store and transport charge, helping explain why their electrical recovery can differ from simple circuit predictions

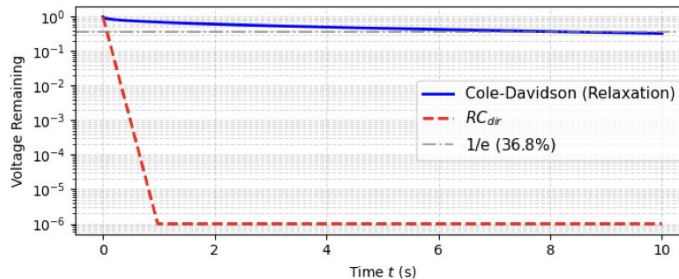
Bakelite



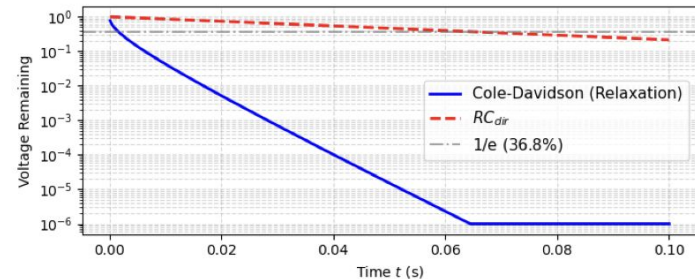
Float Glass



Chinese Glass



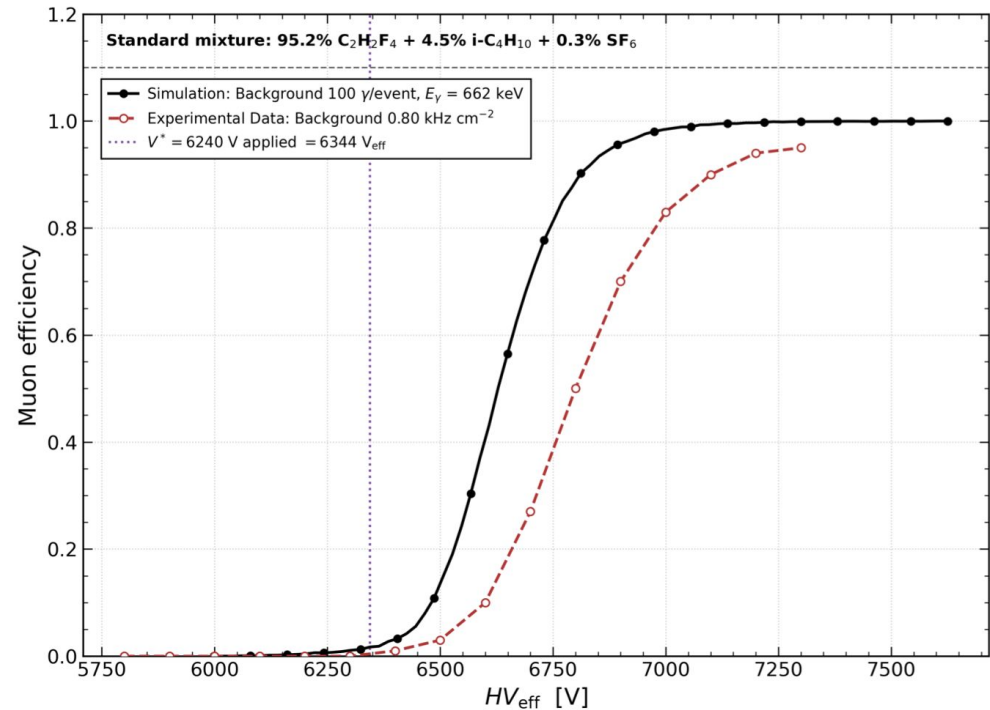
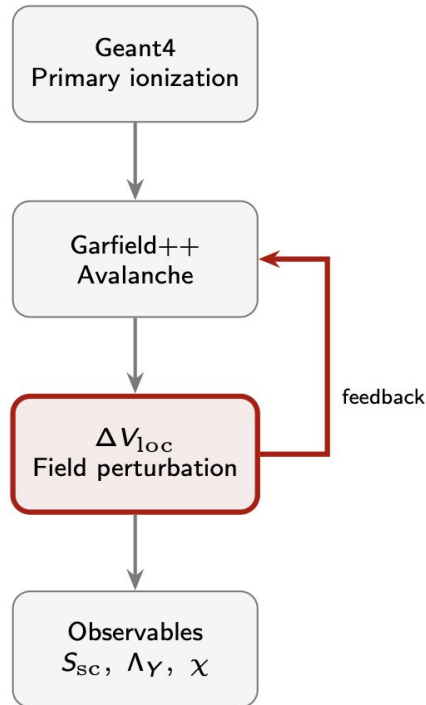
Crispin Glass



Physics and Simulation: **Space-Charge Feedback in RPC Avalanches**

Victor Olenin Ramírez Beltrán

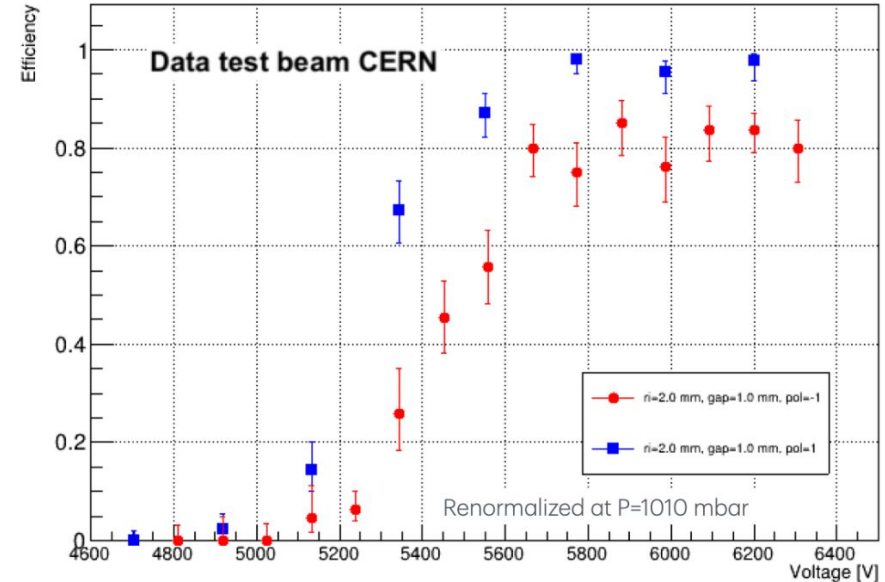
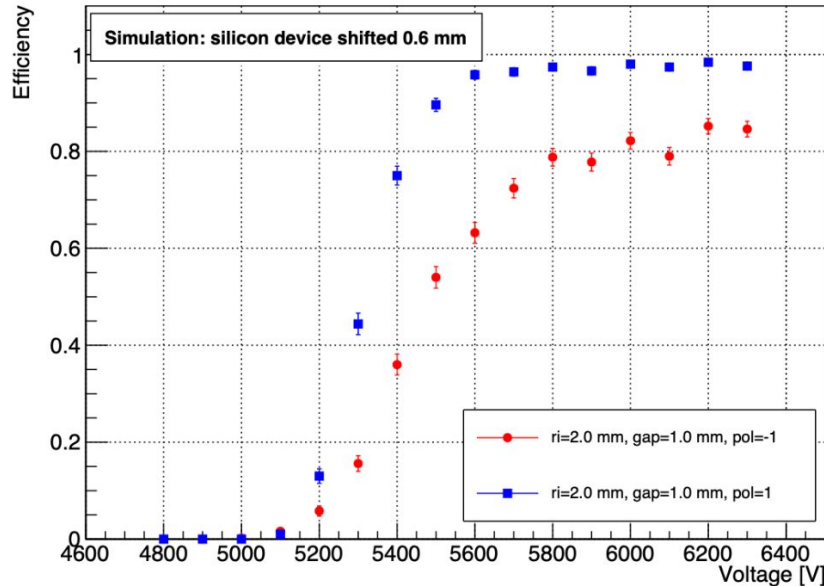
Simulations show how an avalanche changes its own electric field and identify a characteristic voltage that could help compare gas mixtures before beam tests



Physics and Simulation: **Simulating Cylindrical RPCs**

Daive Piccolo on behalf of the TANGO_RD project

A new simulation captures how reversing electrode polarity changes cylindrical RPC efficiency, with further refinement needed to match beam-test data



Physics and Simulation

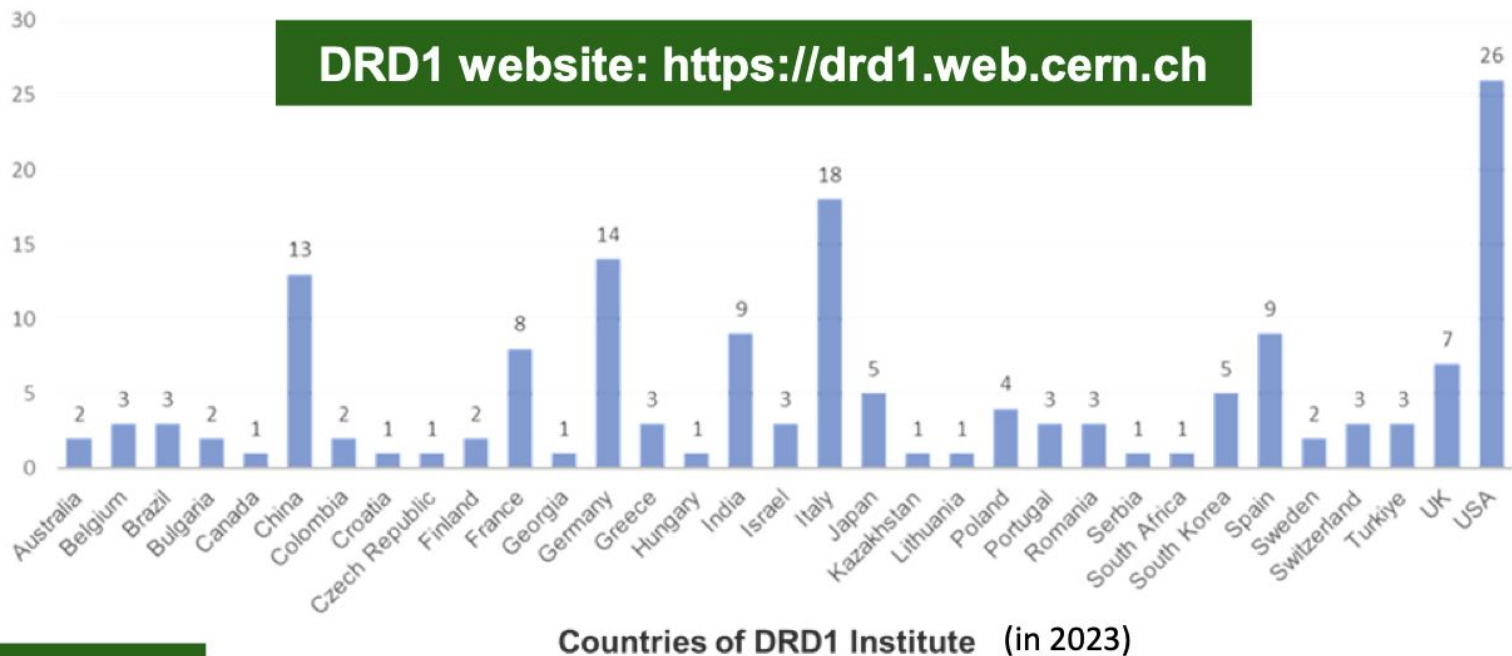


Together, these studies show how better models of gas avalanches, electrode materials and signal readout can improve our understanding and design of RPC detectors

Plenaries: **DRD1: A Global Framework for Gaseous-Detector R&D**

Marcello Abbrescia

DRD1 brings together more than 700 researchers from 133 institutes to coordinate gaseous-detector R&D through shared working groups, projects, facilities and tools



Plenaries: **DRD1: A Global Framework for Gaseous-Detector R&D**

Marcello Abbrescia

DRD1 is expanding its activities beyond CERN, while the absence of contributions from the Americas in the WG4 example highlights clear room for stronger Global-South participation

DRD1 Working Group 4 (WG4): Detector Physics, Simulation and Software Tools

Country	Count	%
BUL	1	1.7%
CHE	14	23.3%
CHN	4	6.7%
CZE	1	1.7%
ESP	5	8.3%
FRA	1	1.7%
GBR	3	5.0%
GER	2	3.3%
HUN	1	1.7%
IND	4	6.7%
ISR	1	1.7%
ITA	15	25.0%
KAZ	1	1.7%
POR	2	3.3%
ROM	3	5.0%
SER	2	3.3%
TOTAL	60	

Region	Count	%
Europe	50	83%
Asia	10	17%
TOTAL	60	

Created with mapchart.net

Alternative Gas Mixtures and Longevity



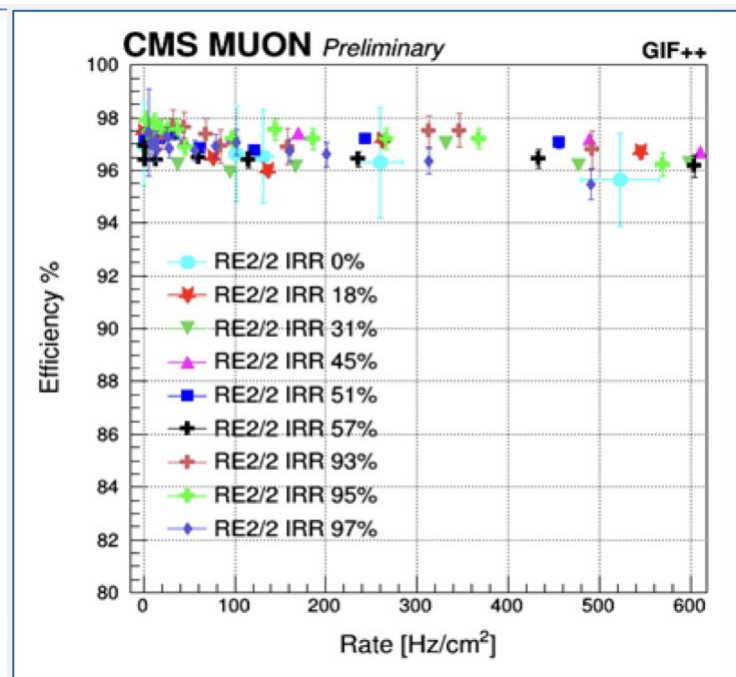
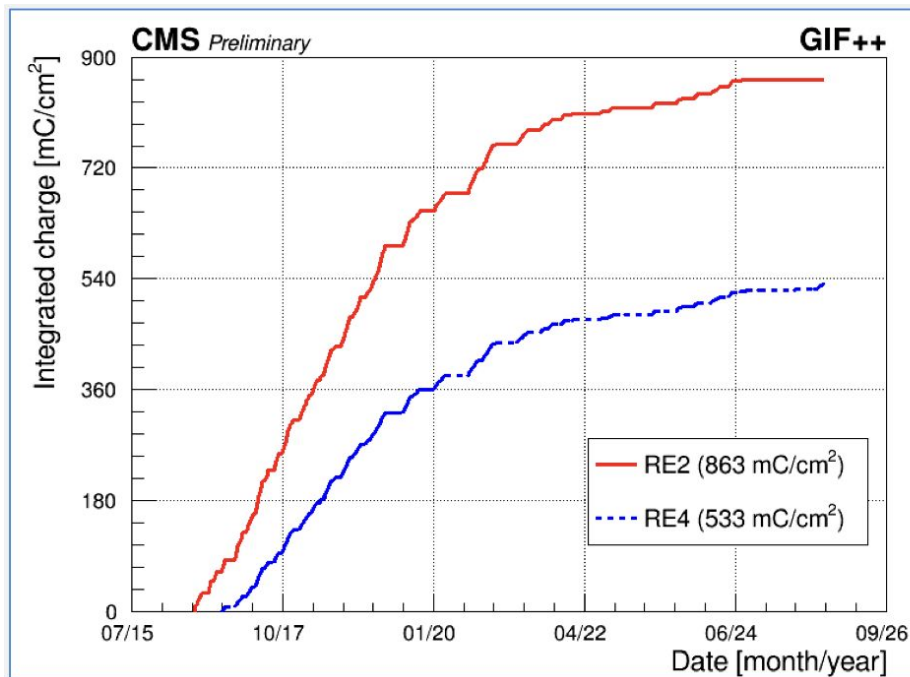
This session covers the search for environmentally sustainable RPC gas mixtures and the studies needed to assess detector ageing, gas-system reliability and long-term operation

Alternative Gas Mixtures and Longevity

Reham Aly on behalf of CMS Collaboration

CMS RPC Longevity and HL-LHC Readiness

CMS RE2 chambers maintained stable efficiency after reaching the full HL-LHC irradiation target; RE4 longevity tests are still ongoing

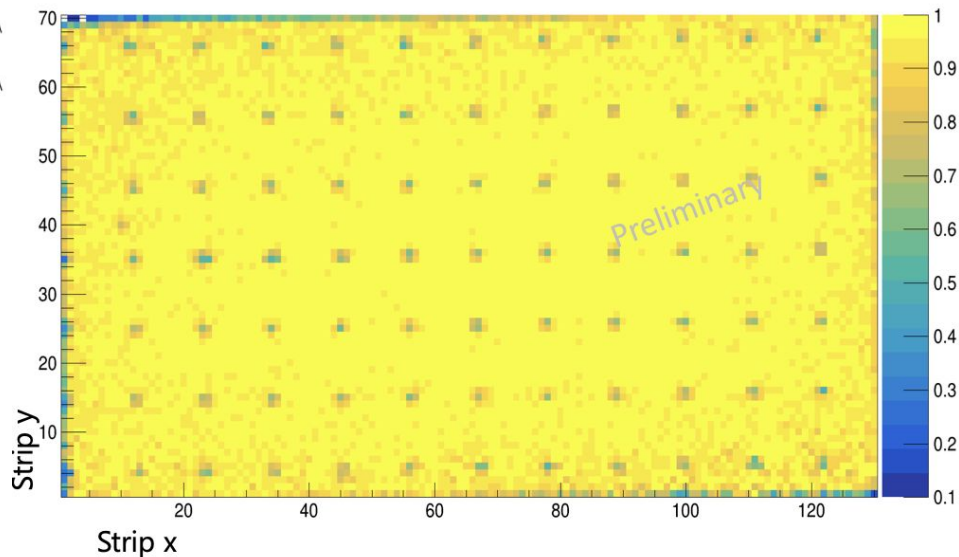
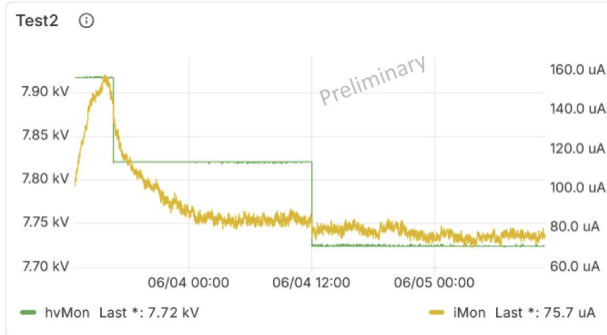
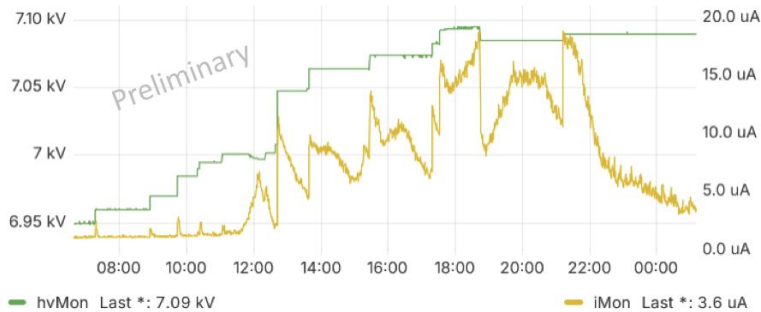


Alternative Gas Mixtures and Longevity

Alessandro Ferretti on behalf of ALICE Collaboration

Ageing and Recovery of ALICE MID RPCs

Old ALICE RPC spares remain efficient despite high currents, while tests of a removed chamber revealed localized inefficiencies but substantially lower noise

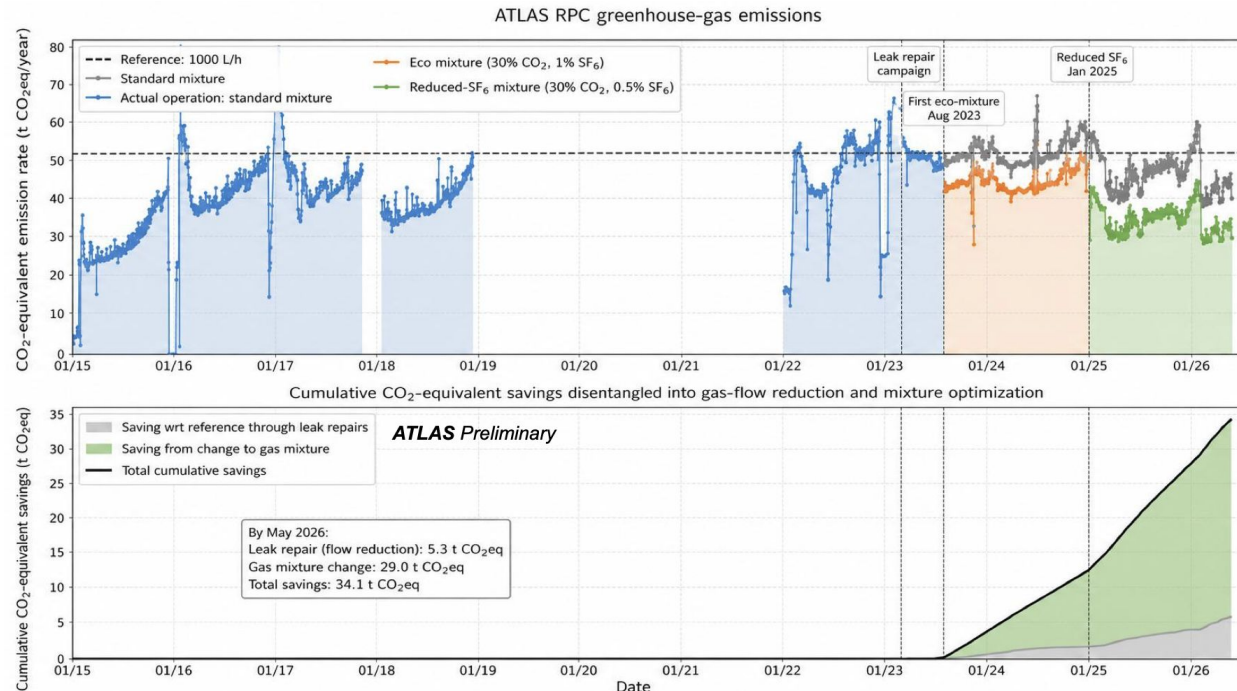


Alternative Gas Mixtures and Longevity

Sinem Şimşek on behalf of ATLAS Collaboration

ATLAS Gas Leak Mitigation and Low-GWP Mixtures

ATLAS is reducing gas emissions through leak repairs and a 30% CO₂ mixture, while testing a further replacement for SF₆

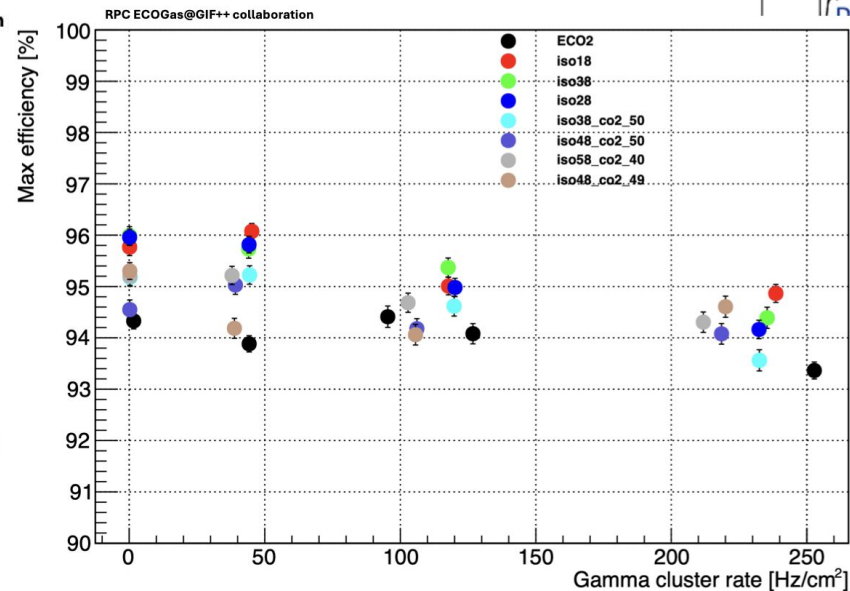
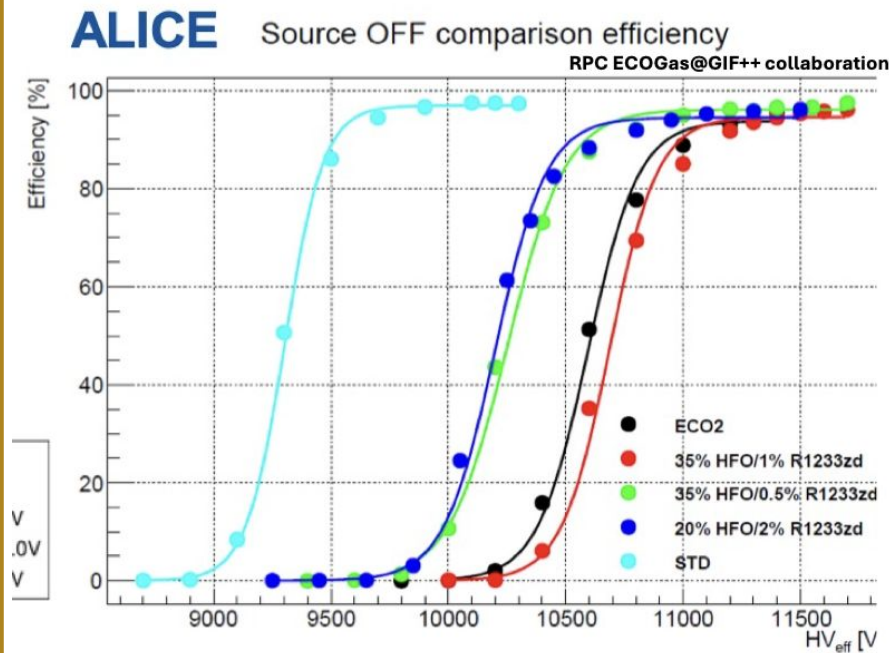


Alternative Gas Mixtures and Longevity

Luca Quaglia on behalf of ECOGAS@GIF++ Collaboration

Towards SF_6 Free RPC Operation

SF_6 -free mixtures offer very low GWP, and added isobutane improves efficiency under irradiation; long-term stability remains to be tested



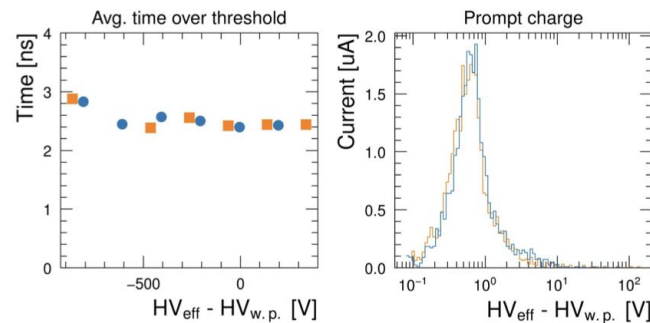
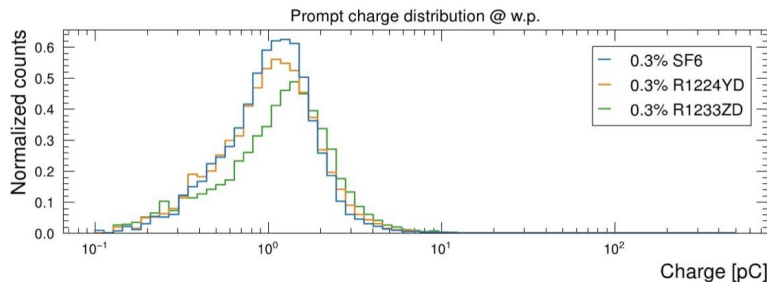
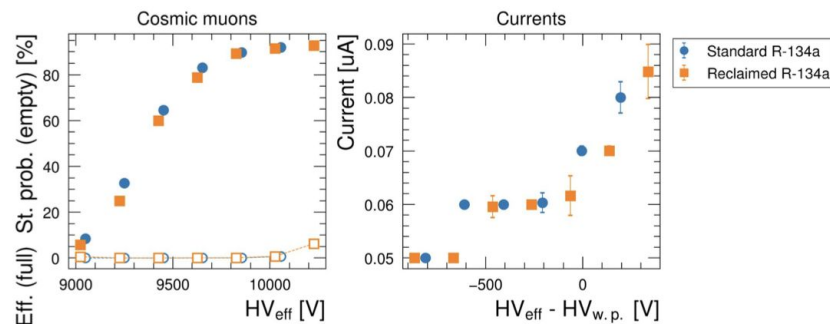
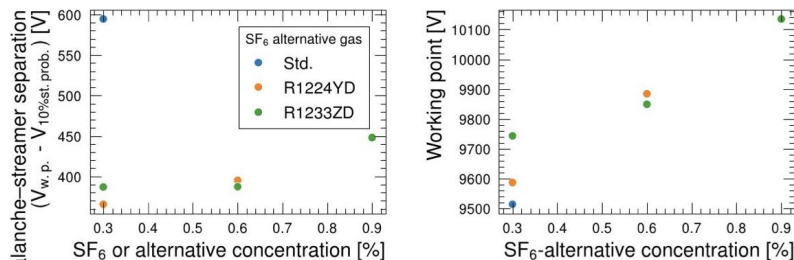
Alternative Gas Mixtures and Longevity

Gianluca Rigoletti on behalf of EP-DT Group

Low-GWP Alternatives to R134a and SF₆

Tests of SF₆ substitutes, hydrocarbon mixtures and reclaimed R134a offer several routes to greener RPC operation, each with remaining validation challenges

Muon beam performance



Alternative Gas Mixtures and Longevity

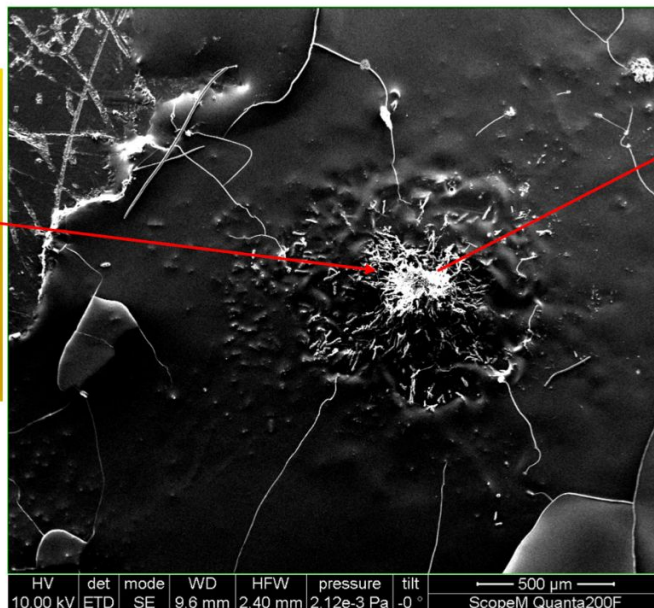
Luca Quaglia on behalf of ECOGAS@GIF++ Collaboration

Material Studies of Eco-Gas Ageing

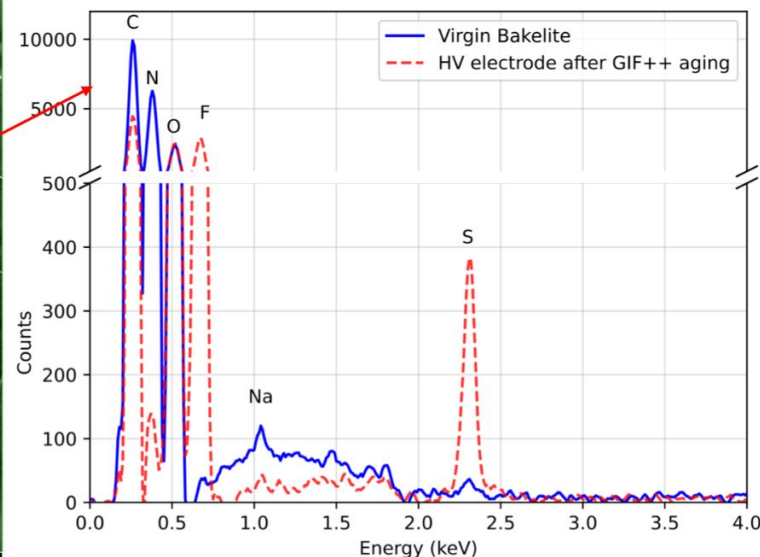
Irradiated RPC electrodes developed fluoride deposits also seen with standard gas, while exposure to HFO/CO₂ alone caused no measurable material changes



Bakelite sample from HV electrode



SEM image of "crater"-like defect



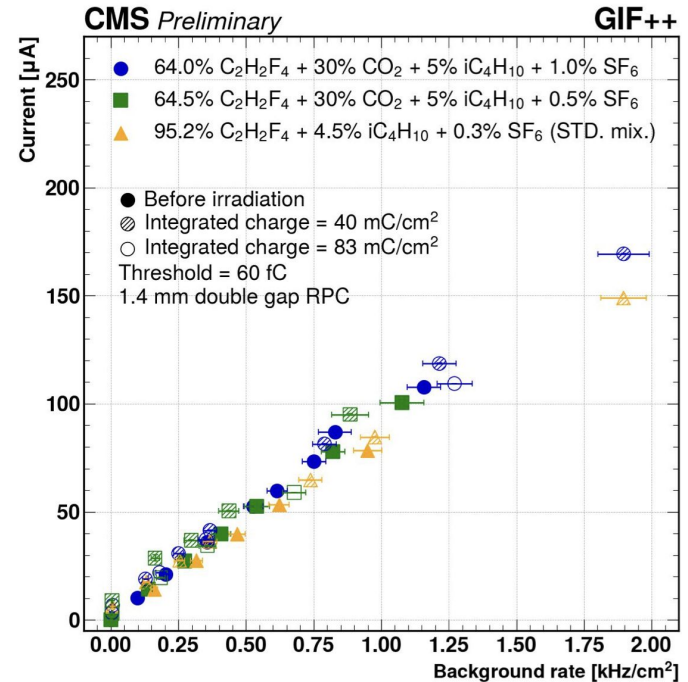
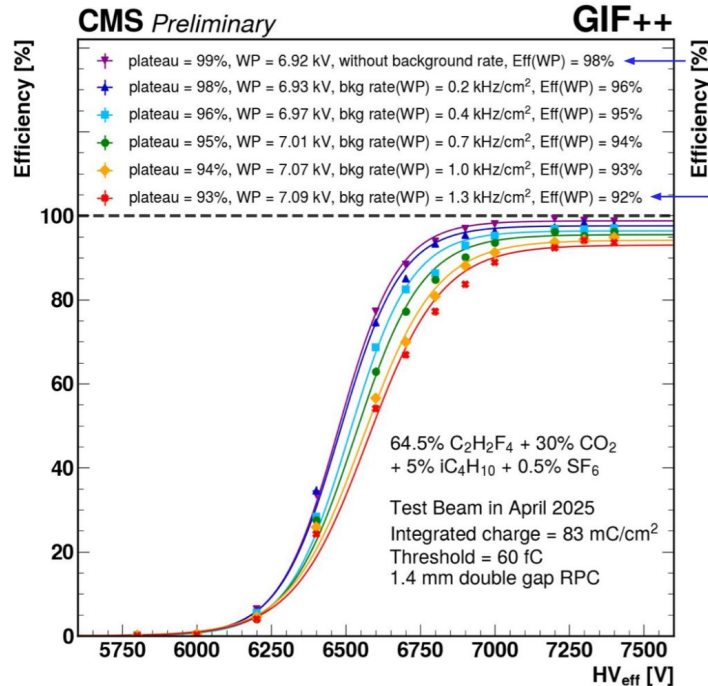
EDX spectrum of "crater"-like defect

Alternative Gas Mixtures and Longevity

João Pinheiro on behalf of CMS Collaboration

Long-Term iRPC Operation with CO₂-Based Mixtures

After 83 mC/cm², CO₂-based iRPC mixtures retained high efficiency without irradiation-related degradation, although their currents were about 20% higher.

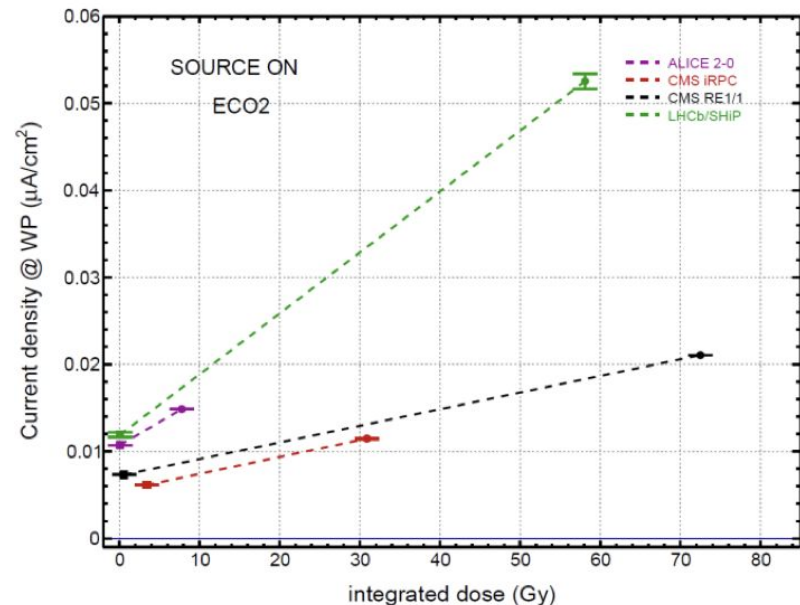
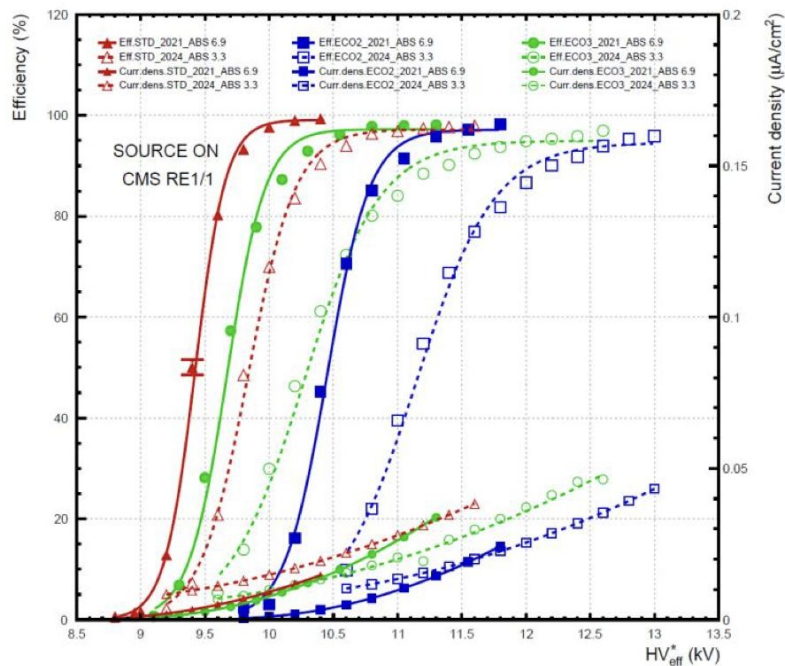


Alternative Gas Mixtures and Longevity

Marcello Abbrescia on behalf of ECOGAS@GIF++ Collaboration

Long-Term Ageing of Eco-Friendly RPC Gas Mixtures

Long-term ECO2 tests largely preserved RPC efficiency, although higher dark currents and operating-voltage shifts still require investigation



ECO2: 35% HFO-1234ze + 60% CO_2 + 4% i- C_4H_{10} + 1% SF_6

Alternative Gas Mixtures and Longevity

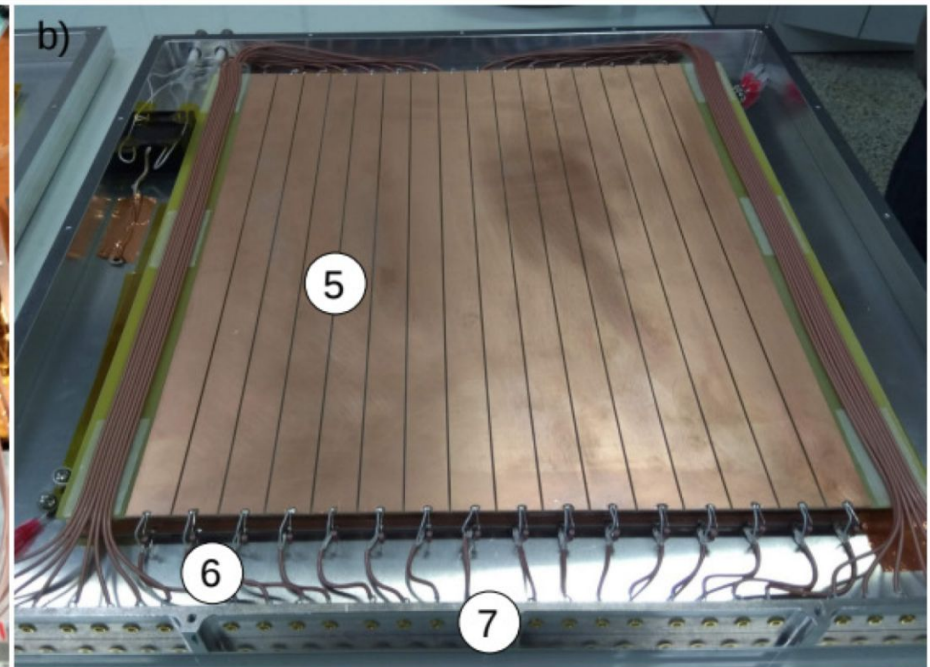
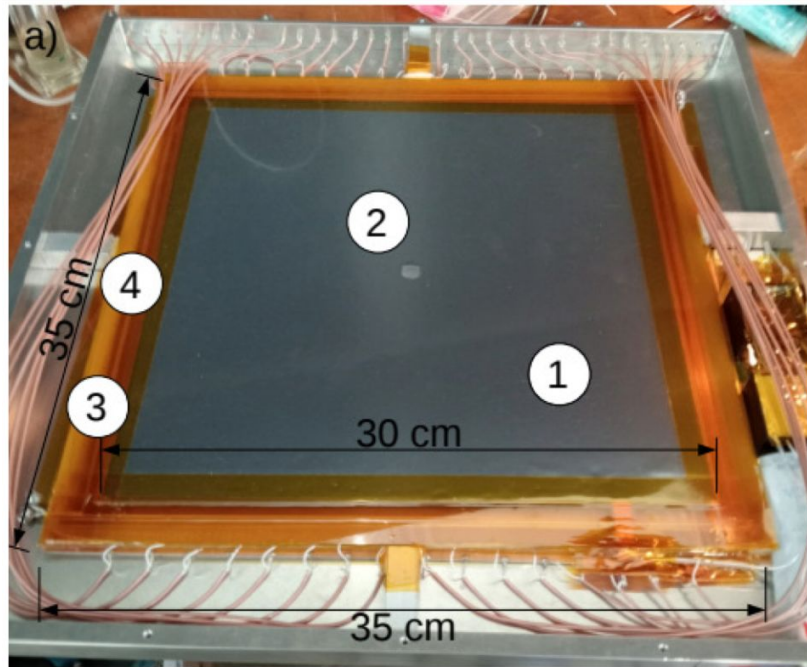


Sustainable RPC operation requires greener gases, leak mitigation and long-term performance validation

Plenaries: **Sealed RPCs: Status and Perspectives**

Luis Lopes

Sealed RPCs aim to preserve conventional RPC performance without continuous gas flow by enclosing the gas in an all-glass, gas-tight structure

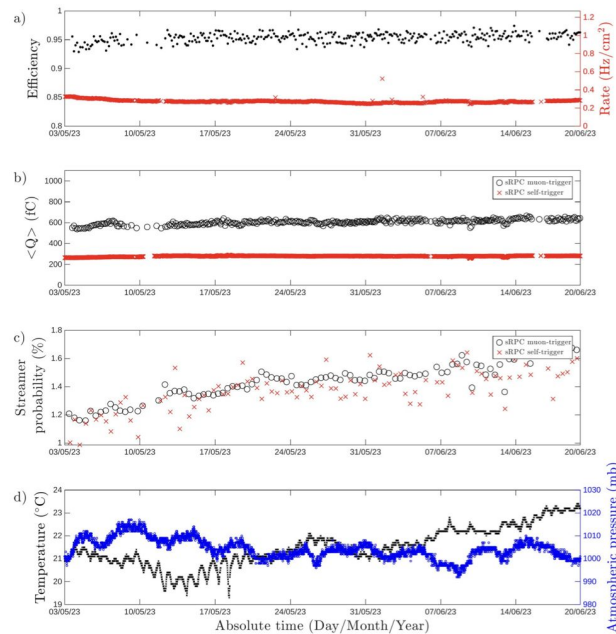
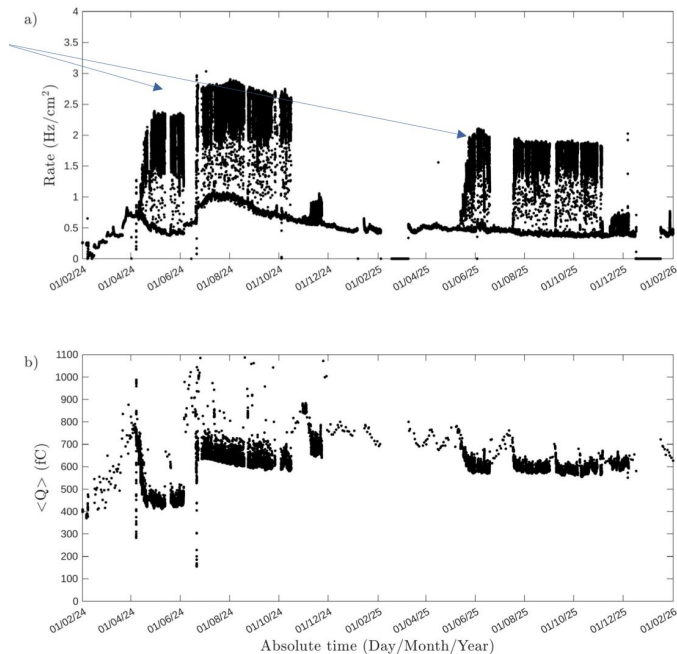


a) 1- HV layer, 2- Circular spacer in the center of the active area, 3- Strip spacer all around the periphery and 4- Mylar and Kapton layers.
b) sRPC plane showing: 5- Readout strip plane, 6- Coaxial cables and 7- MMCX RF feedthrough connectors.

Plenaries: Sealed RPCs: Status and Perspectives

Luis Lopes

30×30 cm² sealed RPCs have operated for more than 800 days at SND@LHC with the same gas mixture and no observed degradation, while the 1 m² prototype revealed important scale-up challenges.



Production and QA

This session focuses on how RPC detectors are manufactured, tested and certified, from component production and assembly to quality control and traceability



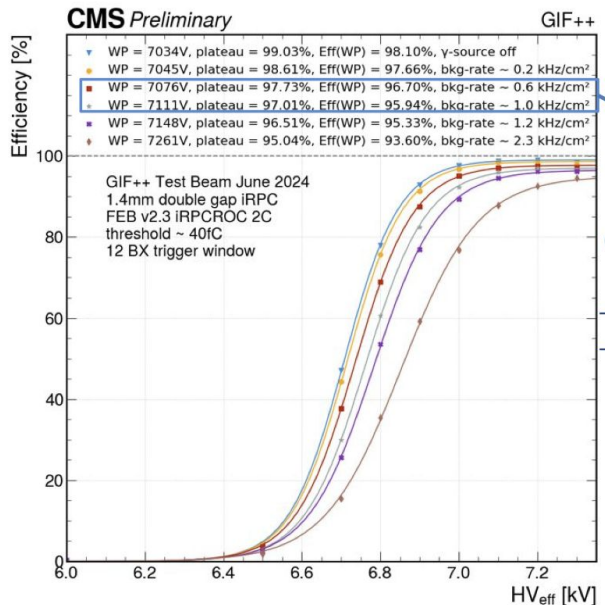
Production and QA: CMS iRPC mass production and performance

Eduardo Coelho on behalf of the CMS Collaboration

The mass production and certification of all 72 CMS iRPC chambers have been completed, with 36 already installed and commissioned. Tests at GIF++ show efficiencies of 96–96.7% under high background rates

Efficiency curves

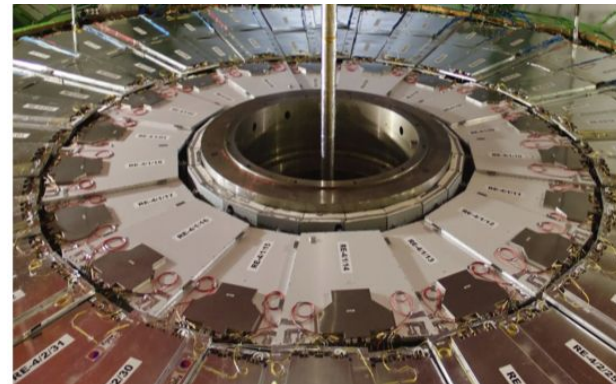
- threshold @ ~ 40 fC
- 12 BX trigger window



@ bkg-rate = 600-1000 Hz/cm²:

→ Efficiency = 96 - 96.7 %

→ Working Point = 7.07 - 7.11 kV

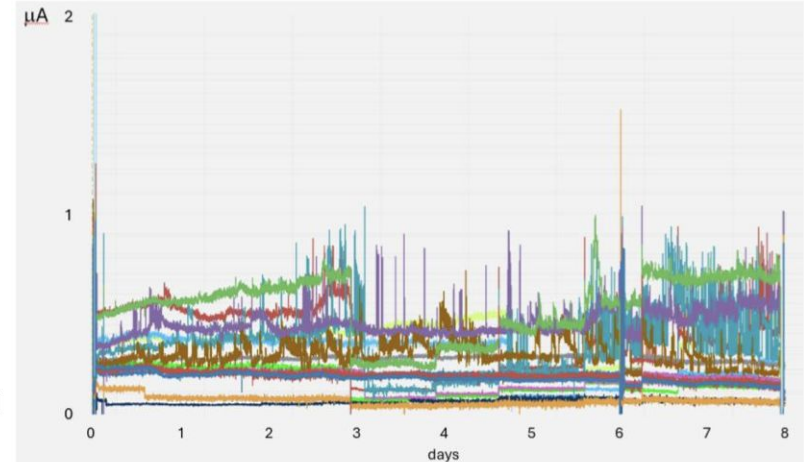
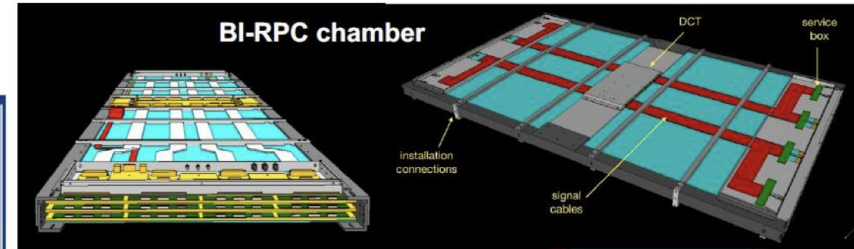
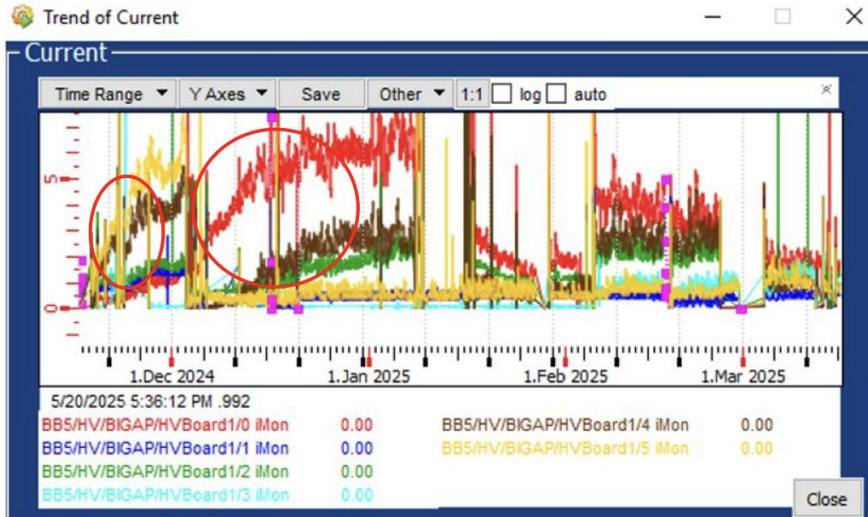


	Required	Assembled	QC4.2 Long-term stability	QC4.3 Cosmic test	Installed
RE3/1	36	41	40	40	18
RE4/1	36	40	40	40	18
Total	72	81	80	80	36

Production and QA: **ATLAS RPC gas volumes: Production and QA/QC**

Paolo Camarri on behalf of the ATLAS Collaboration

Improved gluing procedures resolved gas leaks and current drifts in ATLAS upgrade gas volumes, while production and quality assurance continue towards 2027 installation

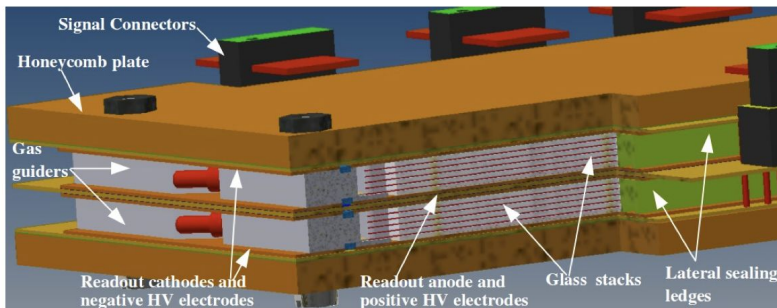


Long-term current monitoring of 6 BI gas volumes at CERN from December 2024 till March 2025. The «current drifts» are circled

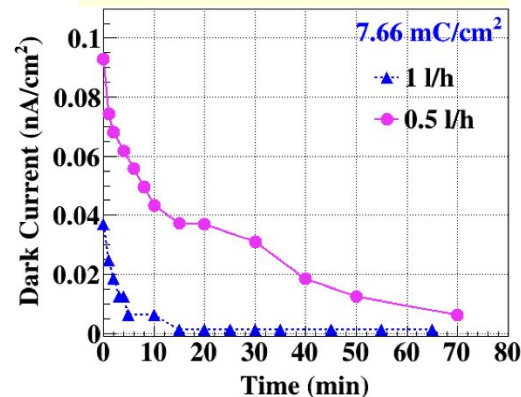
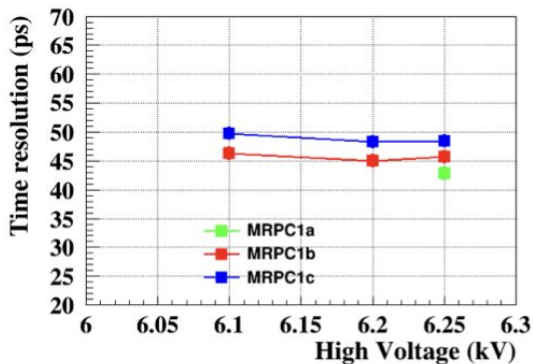
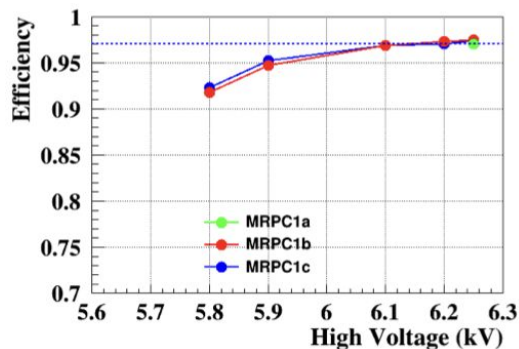
Production and QA: **Next-generation MSMGRPCs for high interaction rates** - Mariana Petris

A new MSMGRPC architecture combining direct gas flow and discrete spacers mitigates ageing effects while maintaining good performance at high counting rates.

Multistrip Multigap Resistive Plate Chamber - MSMGRPC



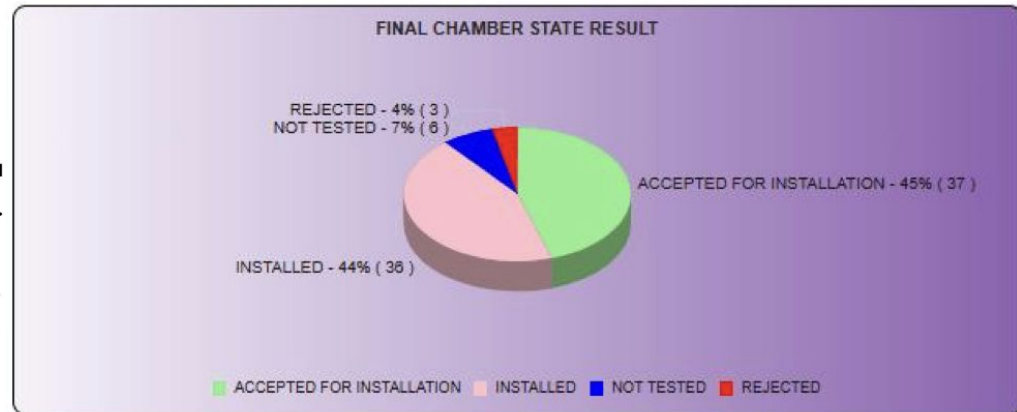
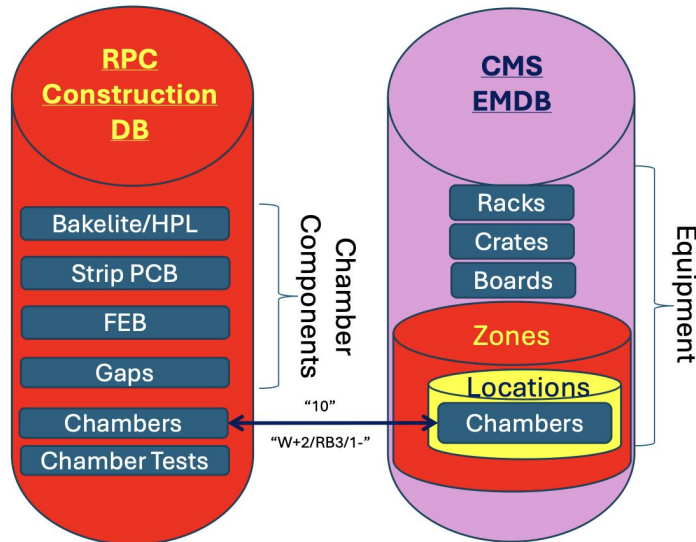
Test beam and cosmic-ray runs support its suitability for the CBM-TOF inner wall, where assembly of the first detector module is approaching completion.



Production and QA: **CMS RPC Construction Database**

Anton Dimitrov on behalf of the CMS Collaboration

The CMS RPC Construction Database provides complete traceability of detector components, construction, testing and certification across different RPC generations. By linking production records to the installed chambers, it supports long-term quality assurance, maintenance and future detector interventions.



Production and QA

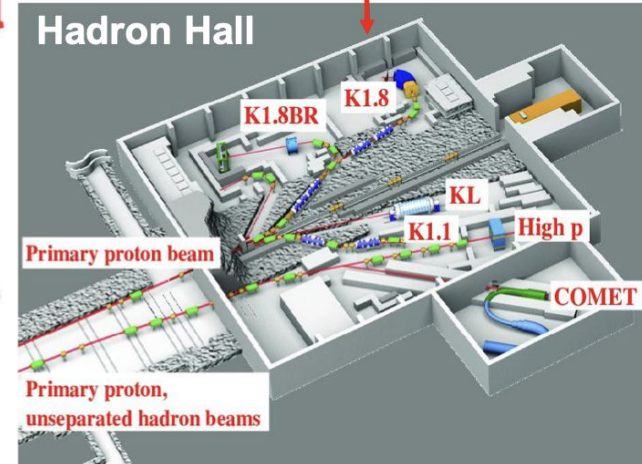
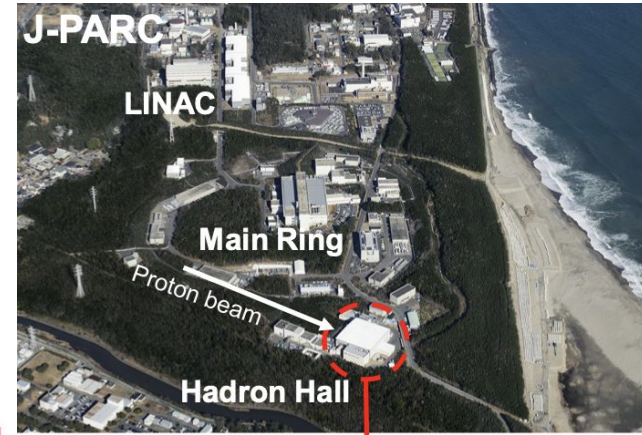
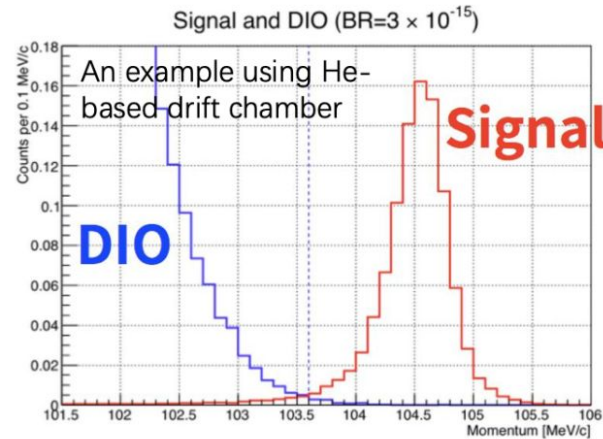
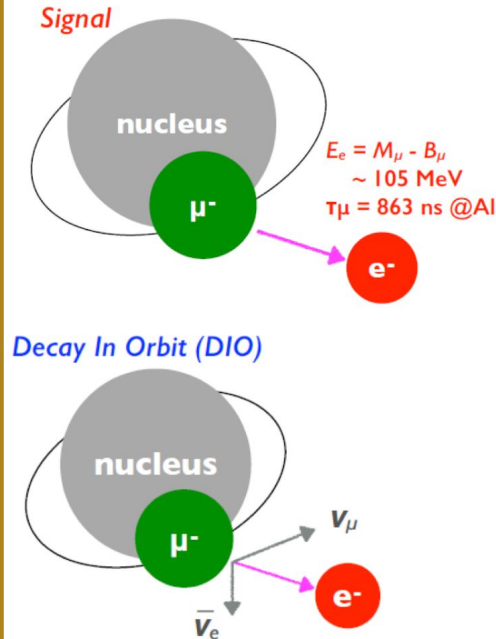


Across different experiments, the common theme is clear: successful detector upgrades require not only improved performance, but also reliable mass production, rigorous quality assurance and long-term traceability

Plenaries: **COMET** experiment and opportunities

Yi Yuan on behalf of the COMET Collaboration

COMET searches for the neutrinoless conversion
 $\mu N \rightarrow e N$, where a 105 MeV electron would
 provide a clean signature of charged-lepton flavor
 violation



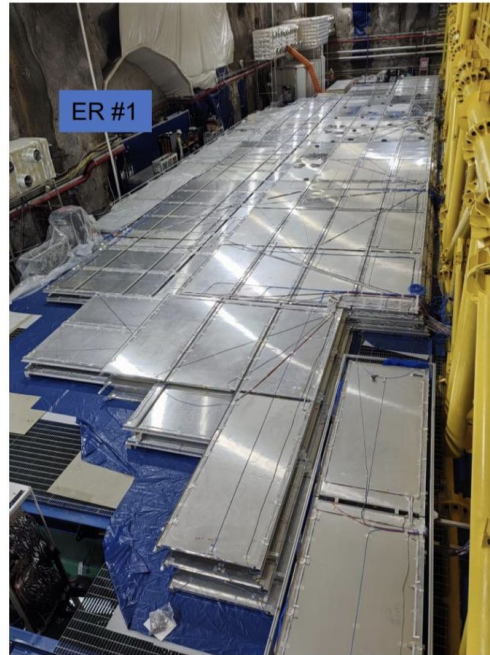
Plenaries: **COMET experiment and opportunities**

Yi Yuan on behalf of the COMET Collaboration

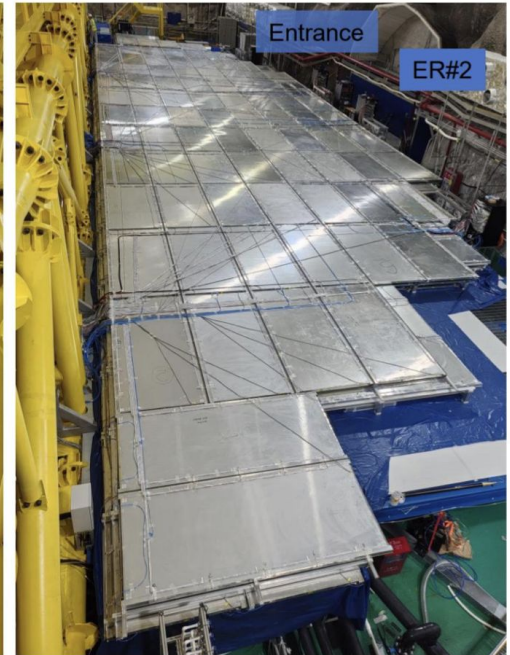
COMET Phase-I will reuse ARGO-YBJ RPCs for its cosmic-ray veto, showing a practical and cost-effective new application of large-area RPC technology.

- **1836 ARGO-YBJ RPCs** operated over **$\sim 6700 \text{ m}^2$**
- Chamber performance: **$\sim 98\%$ efficiency** and **$\sim 1 \text{ ns}$ time resolution**
- **72 RPCs** will be used for the **COMET Phase-I CRV**

Region I (Front of E-Room #1)



Region II (Front of E-Room #2)



HEP and Beyond HEP Applications Techniques



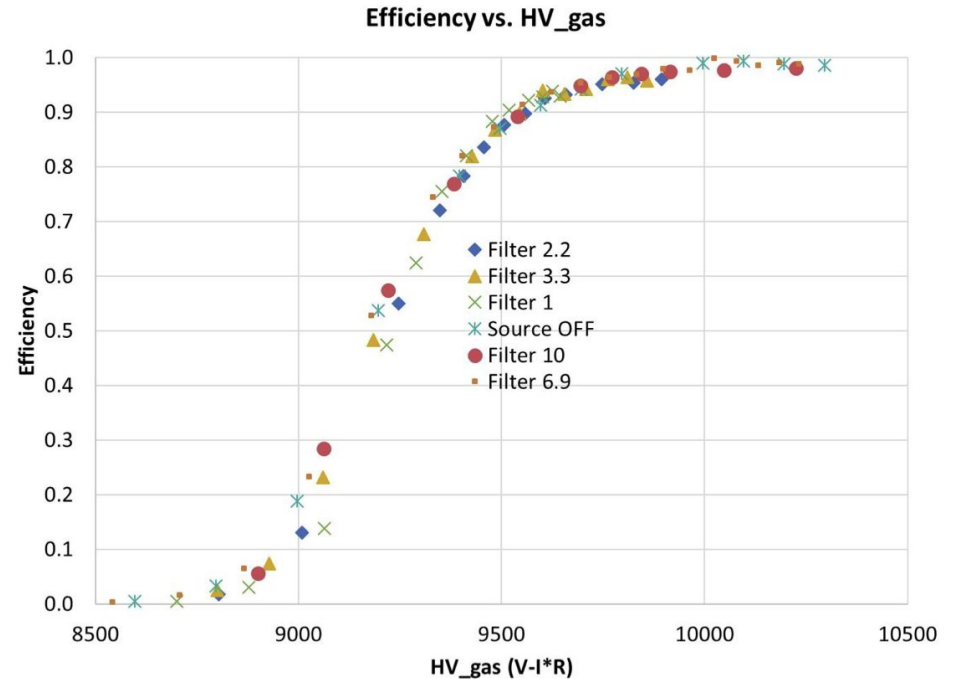
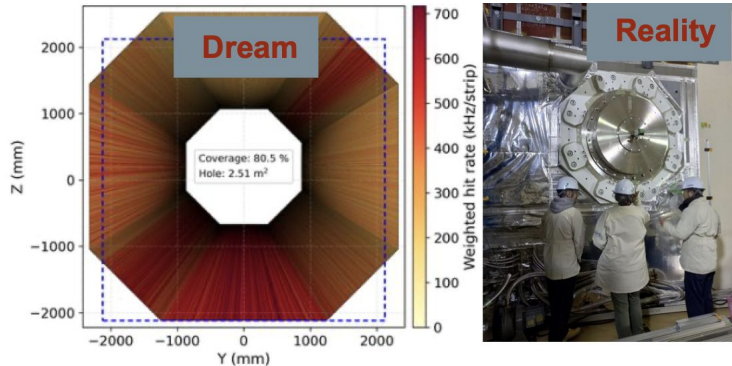
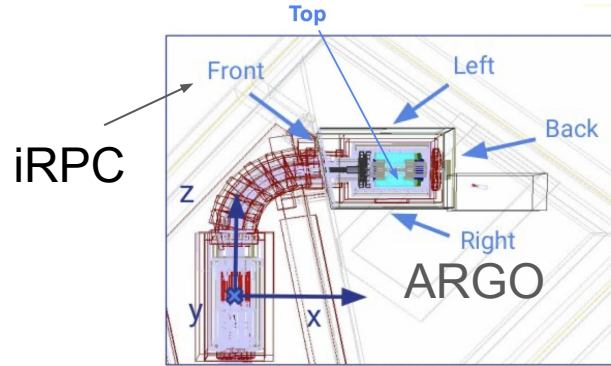
This session explores how RPC detector design, fast timing and readout techniques enable particle searches and cosmic-ray detection, extending their applications from high-energy physics to muography and gamma-ray astronomy.

HEP and beyond HEP applications techniques

RPCs for the COMET Cosmic-Ray Veto

Maxime Gouzevitch on behalf of the COMET Collaboration

COMET Phase-I is developing a cosmic-ray veto high-rate iRPCs with reused ARGO-YBJ chambers, with promising GIF++ performance for both technologies

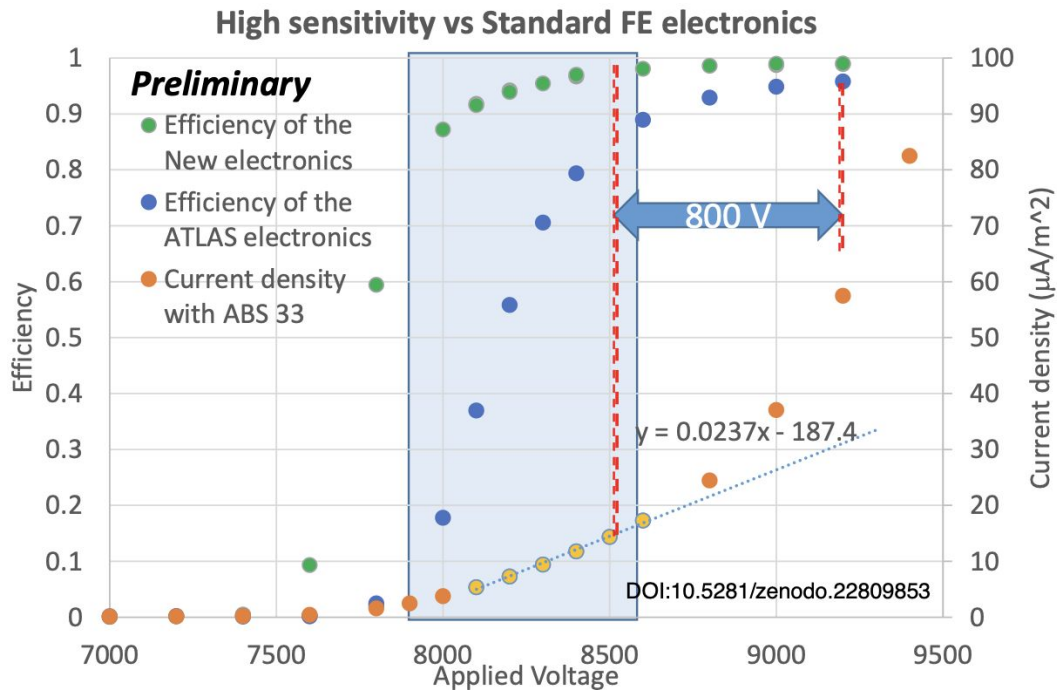
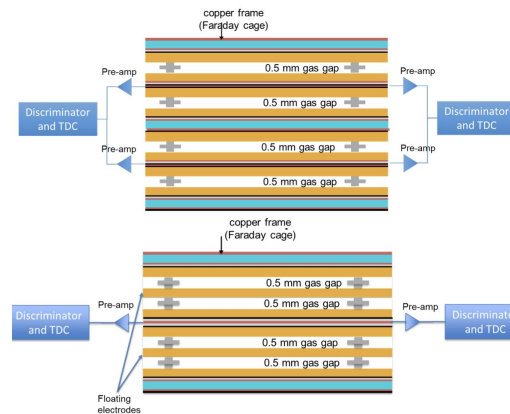
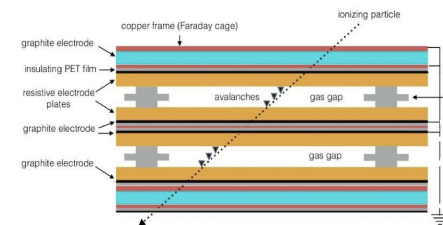
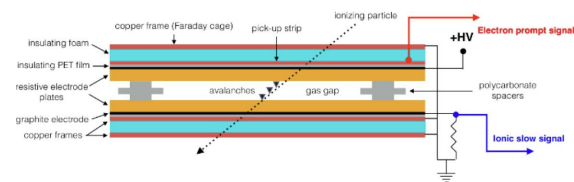


HEP and beyond HEP applications techniques

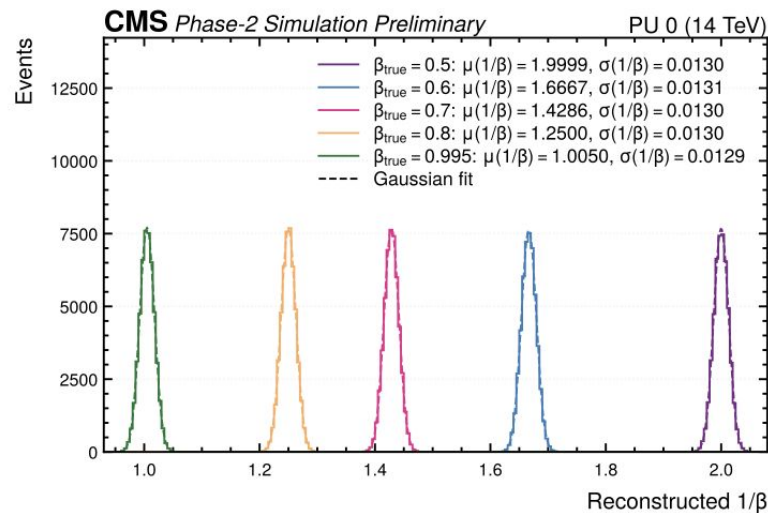
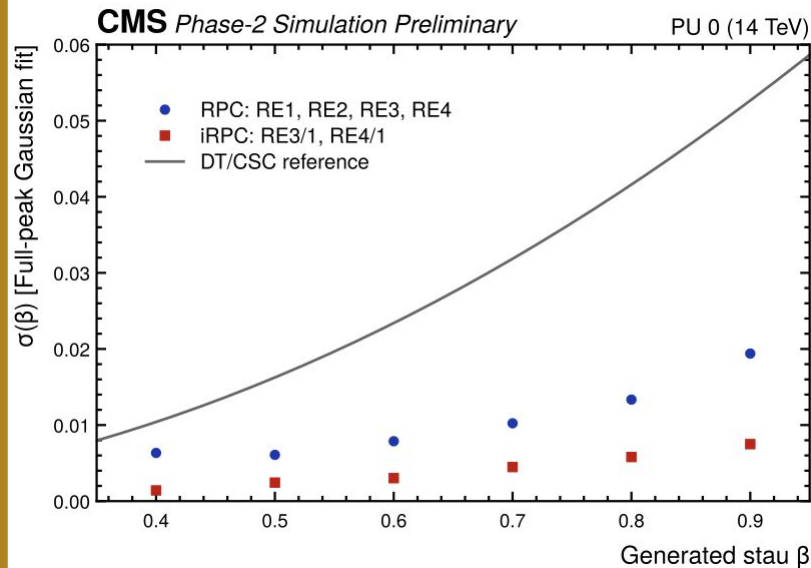
Detector Physics-Driven Concepts for Future RPC Systems

Giulio Aielli

Future RPC concepts are being designed around the physics of gas ionization, more sensitive readout electronics and gap configurations tailored to efficiency and timing requirements



Cosmic-muon measurements and simulations project improved speed reconstruction for heavy, slow particles using upgraded CMS RPCs and iRPCs



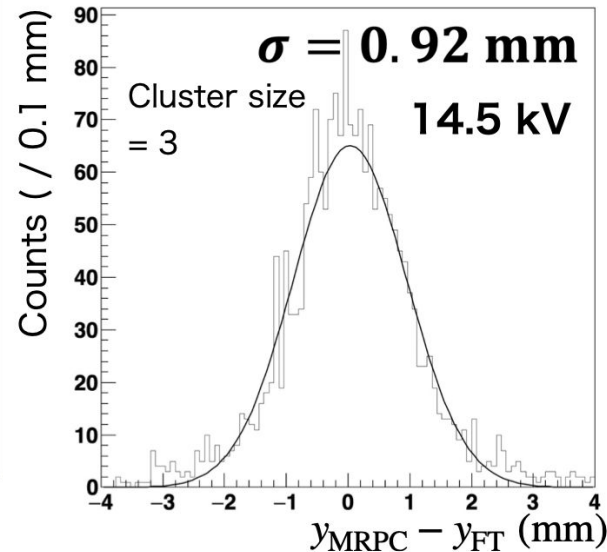
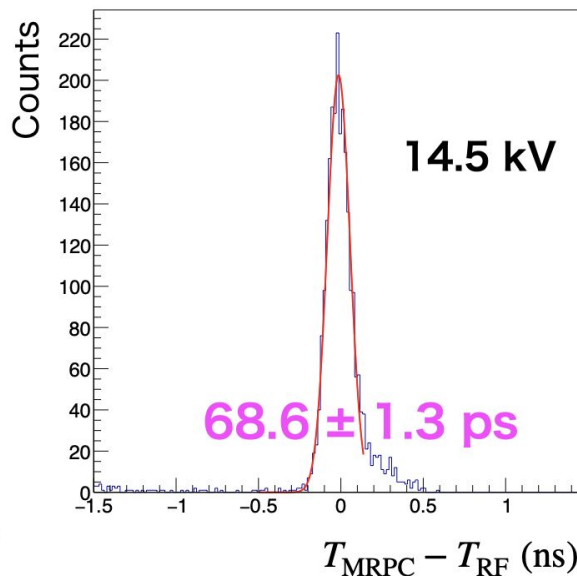
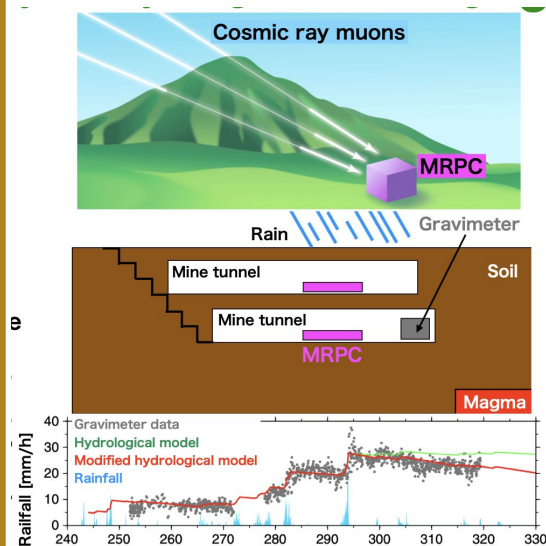
- Projected performance in long distance :
 $\sigma(1/\beta)_{\text{CMS}} = 0.013 < 0.065$

HEP and beyond HEP applications techniques

TOF-Tracker MRPCs for Volcano Muography

Shintaro Tanaka

An upgraded TOF-tracker MRPC improved both timing ($79.8 \rightarrow 68.6$ ps) and position resolution ($>1.1 \rightarrow \sim 0.92$ mm), although its spatial target remains unmet



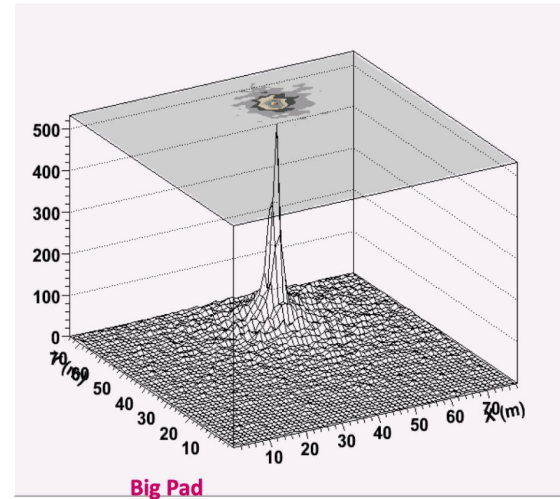
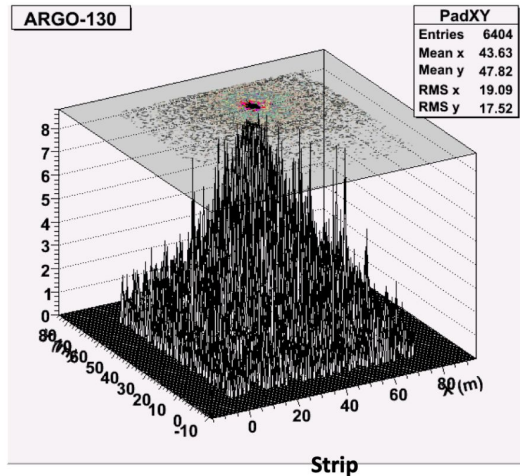
HEP and beyond HEP applications techniques

Gamma ray burst detection over a wide energy range with a ground-based detector

Rinaldo Santonico

Building on ARGO-YBJ, Santonico proposes a new large-pad RPC design for a future Andes gamma-ray observatory; four cosmic-ray-tested prototypes achieved $\sim 97\%$ efficiency and ~ 1.3 ns timing

$E \sim 100$ TeV



HEP and beyond HEP applications techniques

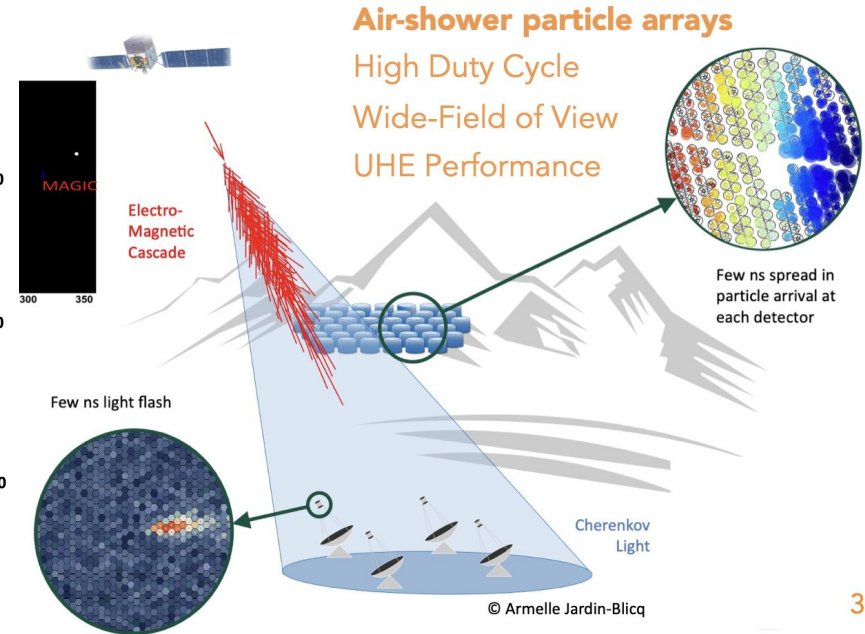
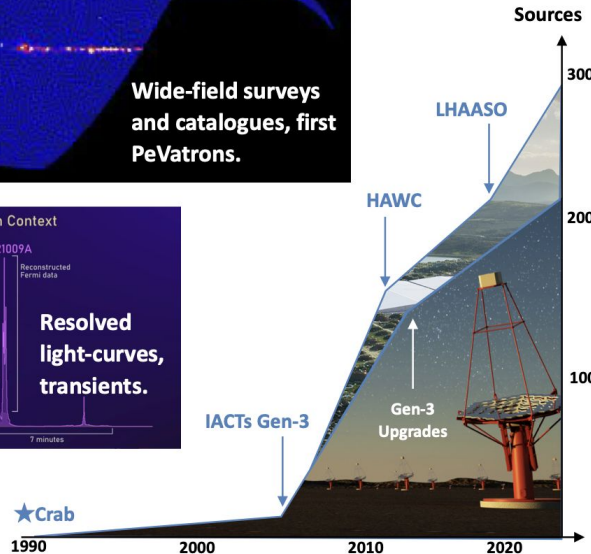
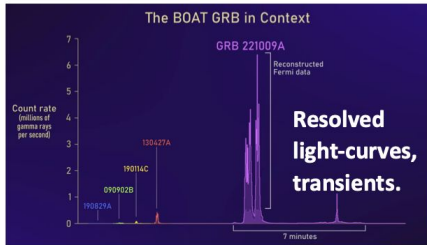
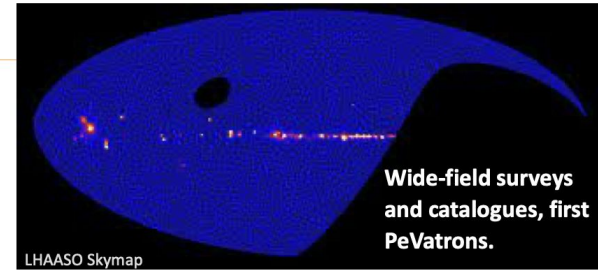


From cosmic-ray vetoes and searches for slow particles to volcano muography and future gamma-ray observatories, tailored RPC designs, improved timing and detector reuse are expanding the applications of RPC technology.

Plenaries: **Ground-Based Gamma-Ray Astronomy**

Ulisses Barres de Almeida

Ground-based gamma-ray astronomy is entering a new era: Cherenkov telescopes provide precision observations, while wide-field air-shower arrays enable nearly continuous monitoring, revealing resolved sources, transients and gamma rays reaching PeV energies



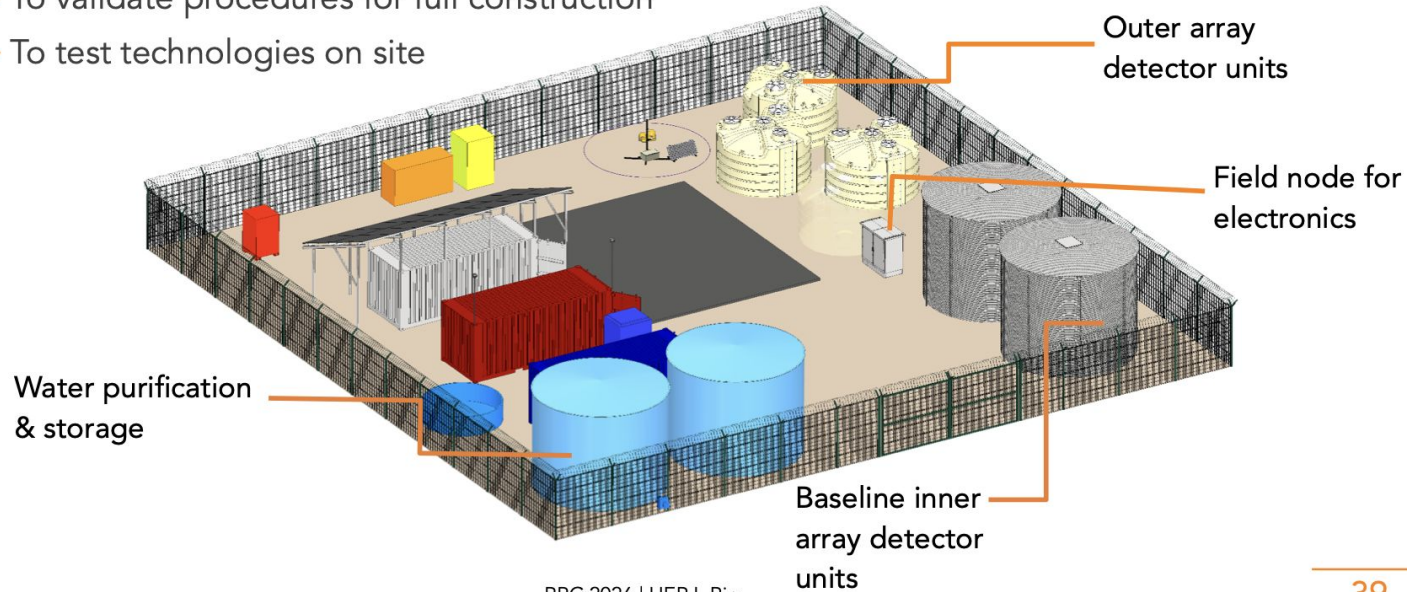
Plenaries: **Ground-Based Gamma-Ray Astronomy**

Ulisses Barres de Almeida

SWG0 aims to complement CTAO with continuous, wide-field observations of the Southern sky; RPCs could provide additional shower-timing information and potentially improve directional reconstruction, provided dedicated tests and funding support their integration

- ◉ 30 x 30 m fenced area within the future array location

- To validate procedures for full construction
- To test technologies on site



Applied research and new ideas

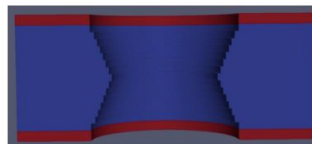
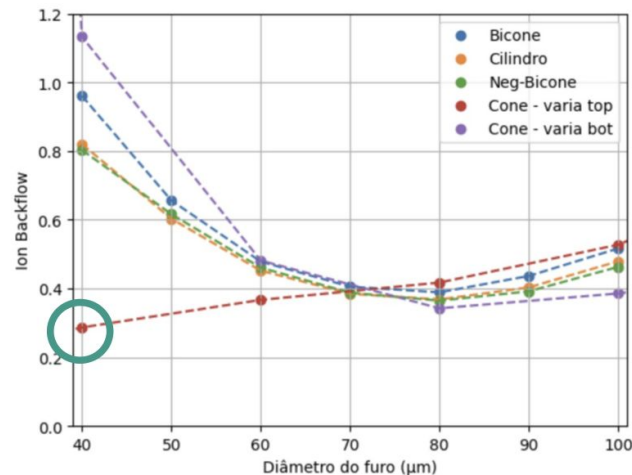
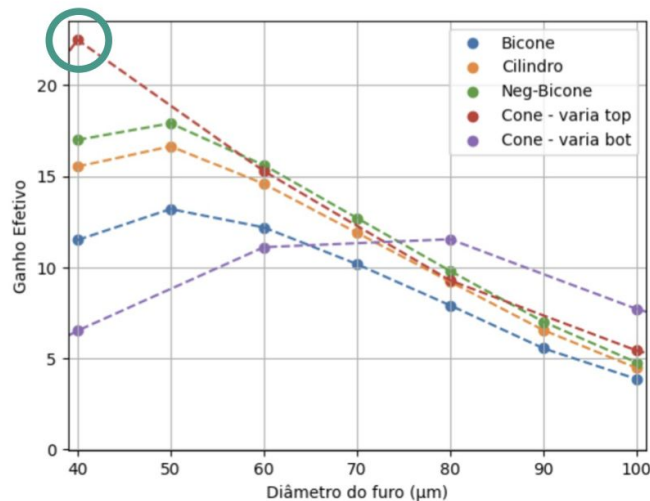


This session explores how advances in detector materials and geometries, laser-driven muon sources, portable and high-rate RPCs, and new trigger, readout and machine-learning techniques can improve detector performance, enable new applications and address environmental challenges

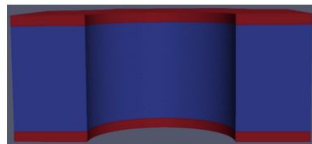
Applied research and new ideas: **GEM Ageing and Flexible Fabrication**

Tiago Fiorini da Silva

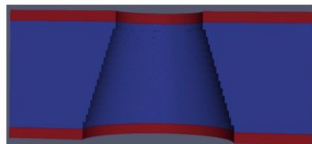
GEM ageing studies combine surface analysis, gas diagnostics and flexible fabrication, offering methods that could also help investigate electrode degradation and improve the long-term reliability of RPCs



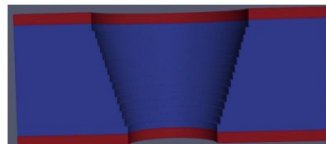
Biconical



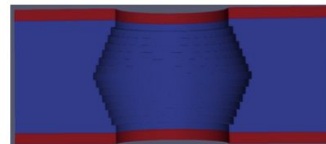
Cylinder



Conical



Conical

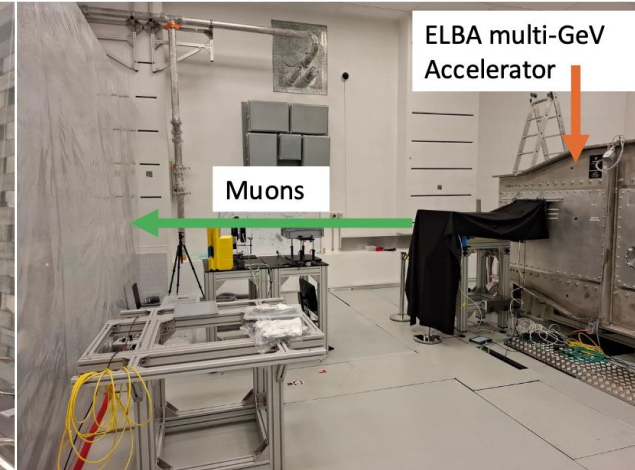
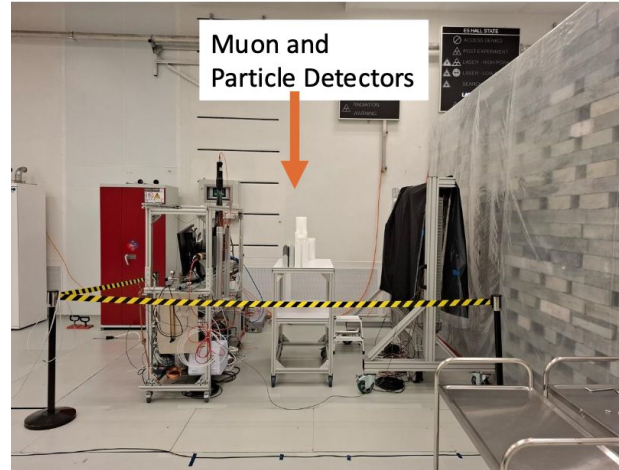
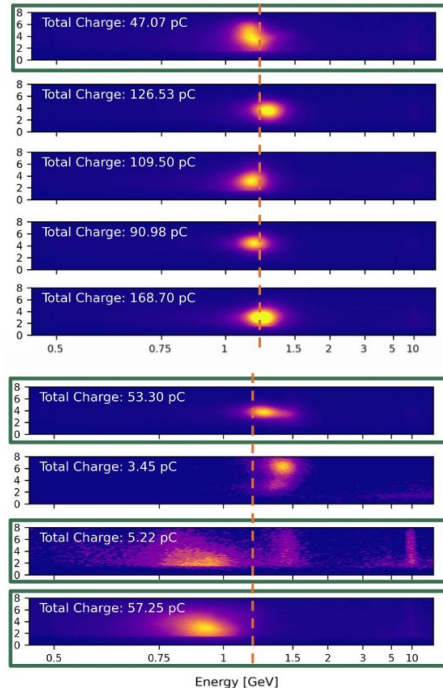


Inverse Biconical

Applied research and new ideas: **Laser-Driven Muon Sources**

Gabriele Maria Grittani

At ELI Beamlines, the ELBA laser-driven accelerator has produced electron beams up to 6 GeV, paving the way for compact secondary-muon sources now being characterized with RPCs and other muon detectors

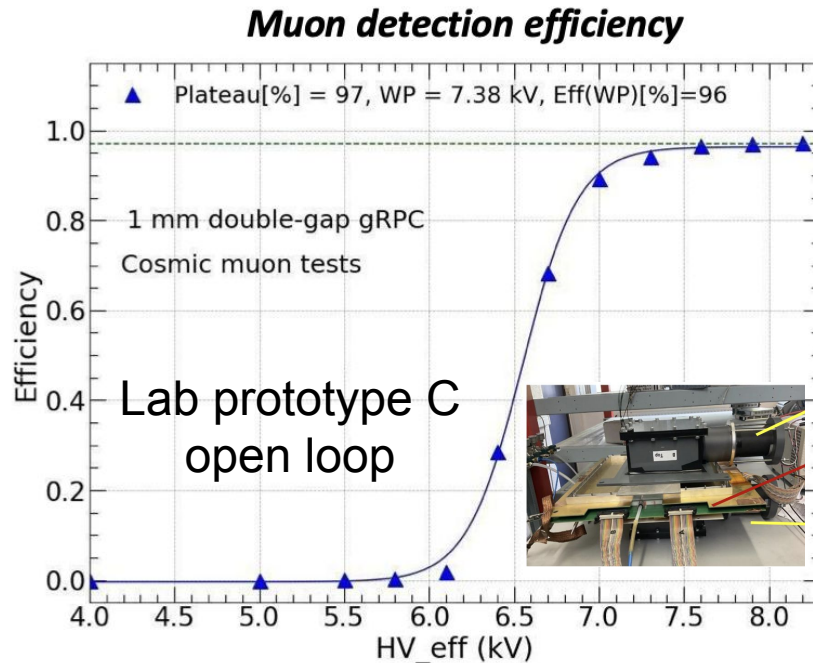


electron-energy spectrum
from a separate laser shot

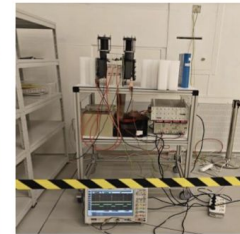
Applied research and new ideas: **Portable Glass-RPCs for Muography**

Michael Tytgat

A double-gap glass-RPC prototype reached ~98% muon efficiency in laboratory tests, while separate sealed RPC telescopes have been deployed at ELI and DESY for ongoing measurements

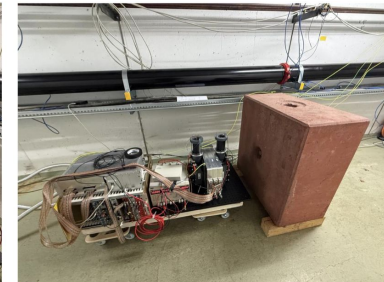


Tests ongoing in ELI beamlines



Sealed
prototype A

Tests ongoing in
DESY-II



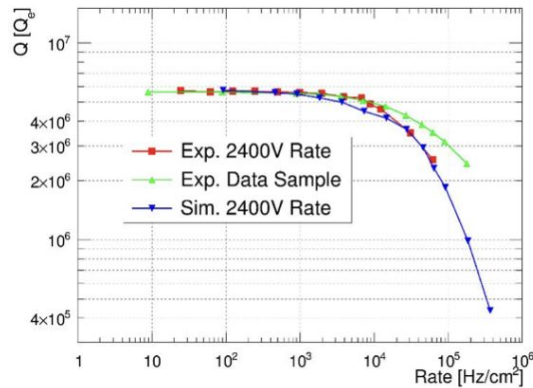
• Data analysis ongoing ...

Applied research and new ideas: **Rate Effects in Photo-RPCs**

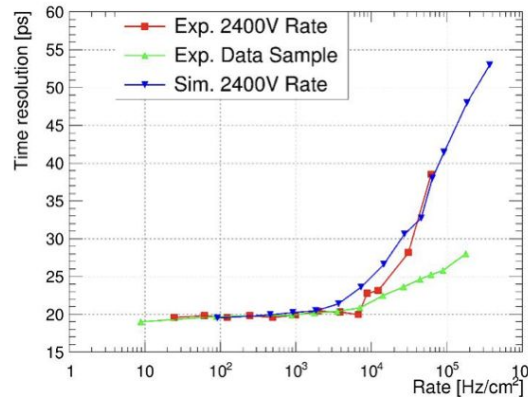
Yiding Zhao

Lower-resistivity electrodes extend photo-RPC rate capability, but timing worsens at high rates even at matched gain; stochastic voltage-drop models reproduce the main trends and support a contribution from local field fluctuations

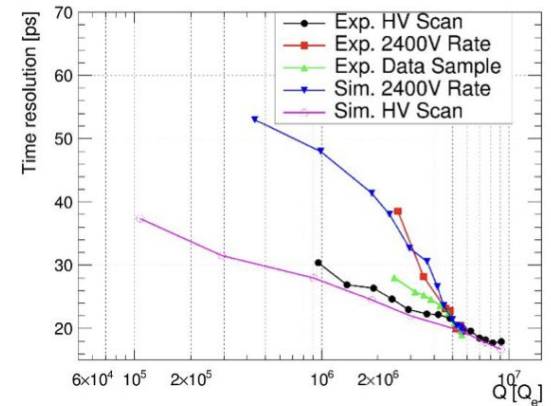
Mean charge



Time resolution



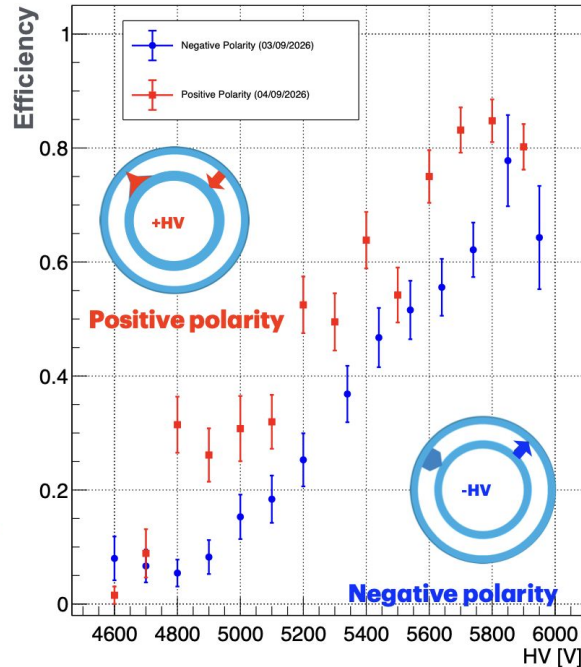
Timing at the same gain



Applied research and new ideas: **First TANGO_RD Cylindrical RPC**

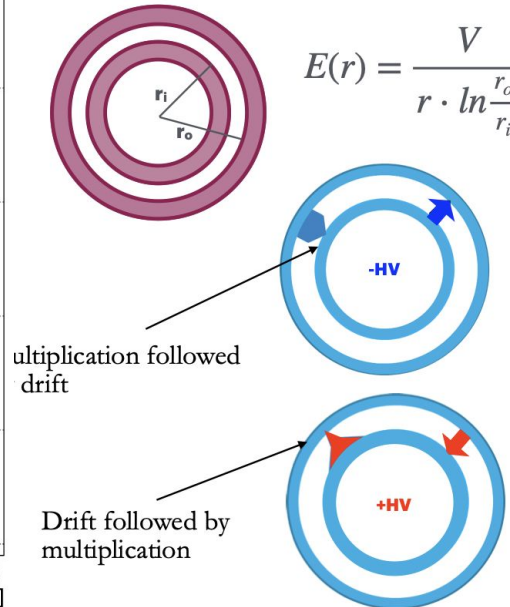
Davide Piccolo

Two new 1 mm-gap glass cylindrical RPC prototypes were built; one withstood ~200 mbar overpressure, while preliminary cosmic-ray tests showed polarity-dependent efficiency and a 1.25 ns timing spread (including scintillator resolution)

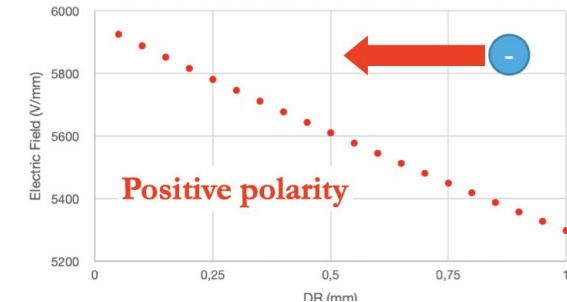
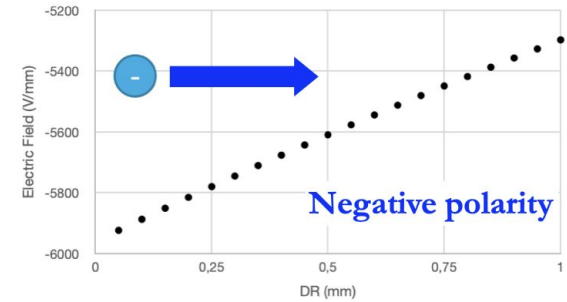


Negative polarity if the inner electrode is at negative voltage vs outer electrode

Positive polarity if the inner electrode is at positive voltage vs outer electrode



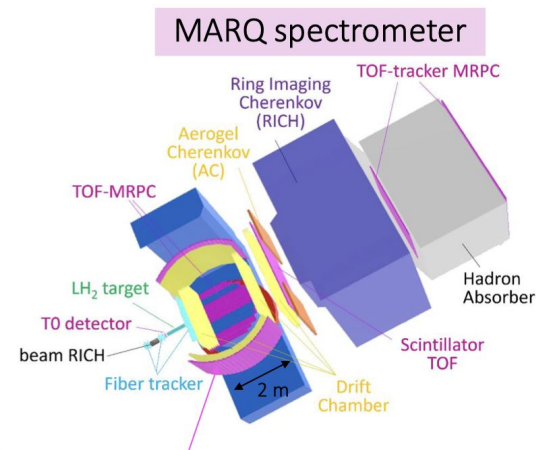
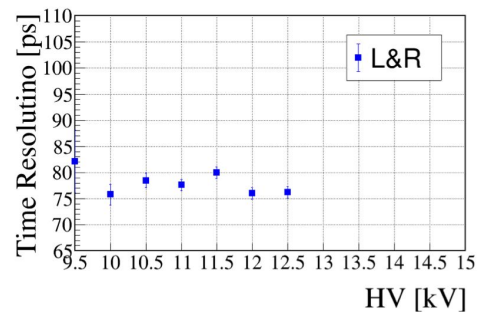
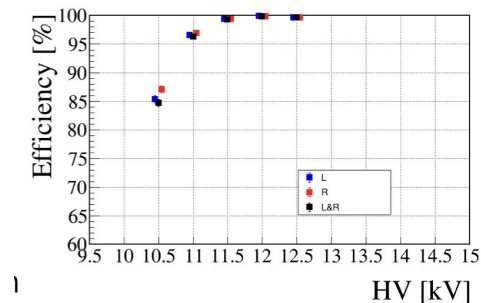
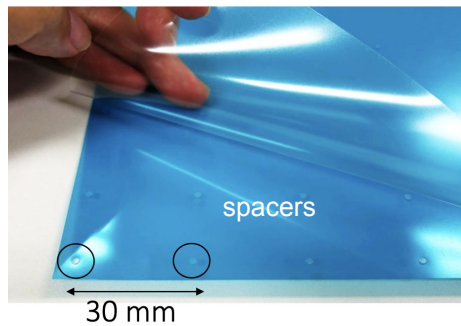
$$E(r) = \frac{V}{r \cdot \ln \frac{r_o}{r_i}}$$



Applied research and new ideas: MRPC Development for J-PARC and Muography

Natsuki Tomida

Microgravure-coated film electrodes achieved over 99% efficiency and time resolution better than 80 ps in beam tests of a 1 m TOF MRPC, while gas-tight construction and new electronics are being developed (test beam Nov/26) for J-PARC and muography.



TOF MRPC Pole face + Wall ($\sim 11 \text{ m}^2$)

Goal : $\sigma_{\text{time}} = 60 \text{ ps}$ $\pi/\text{K}/\text{p}$ PID

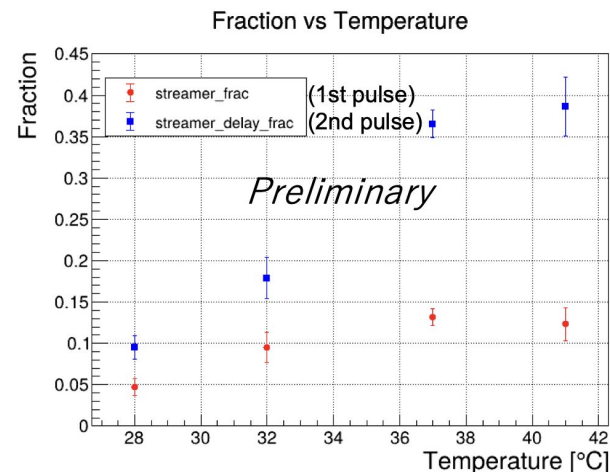
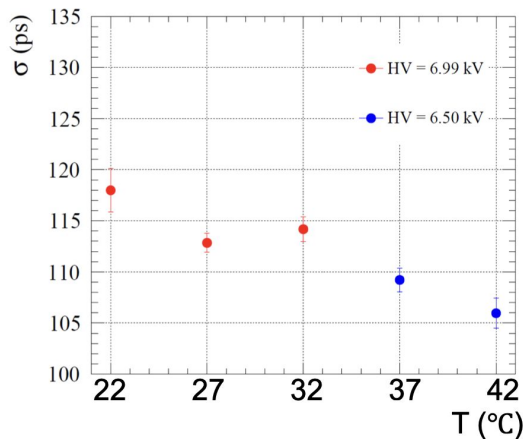
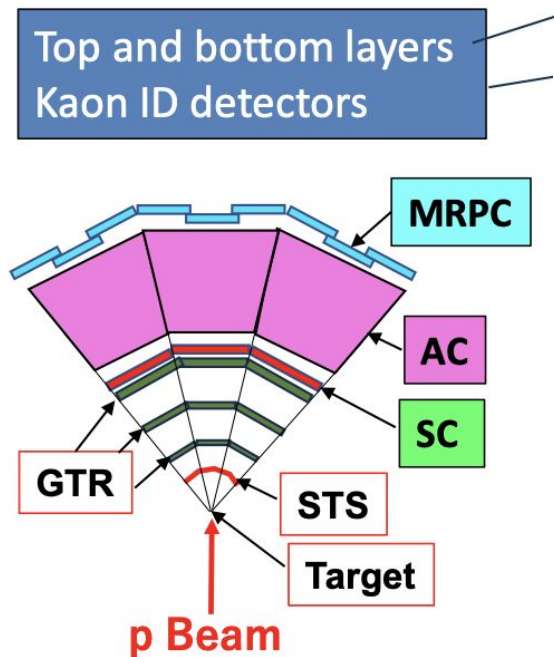
Rate < $100 \text{ Hz}/\text{cm}^2$

Partially share modules with the E88 experiment (H. Sako, next speaker)²

Applied research and new ideas: Warm MRPCs for High-Rate Particle Identification

Hiroyuki Sako

For J-PARC E88's high-rate kaon identification in proton–nucleus collisions, a heated-glass MRPC improved its timing resolution from 118 to 106 ps (22–42 °C), although the streamer fraction increased with temperature

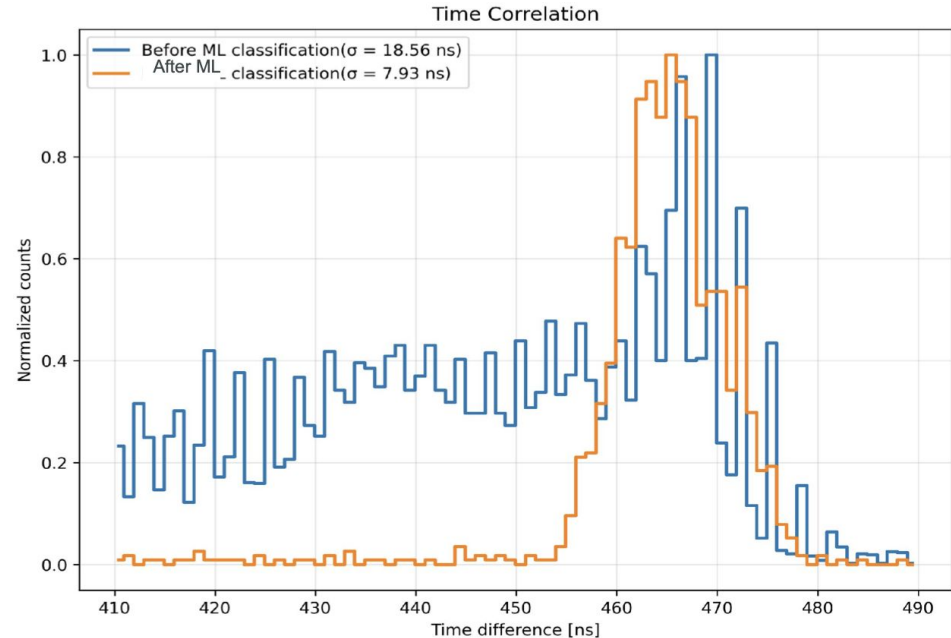
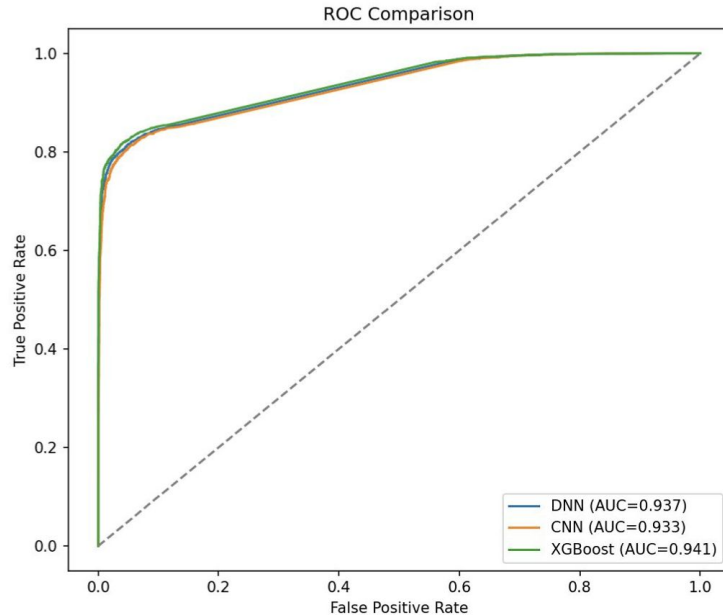


test beam results June/2025

Applied research and new ideas: **ML Suppression of Secondary RPC Hits**

Souvik Chattopadhyay

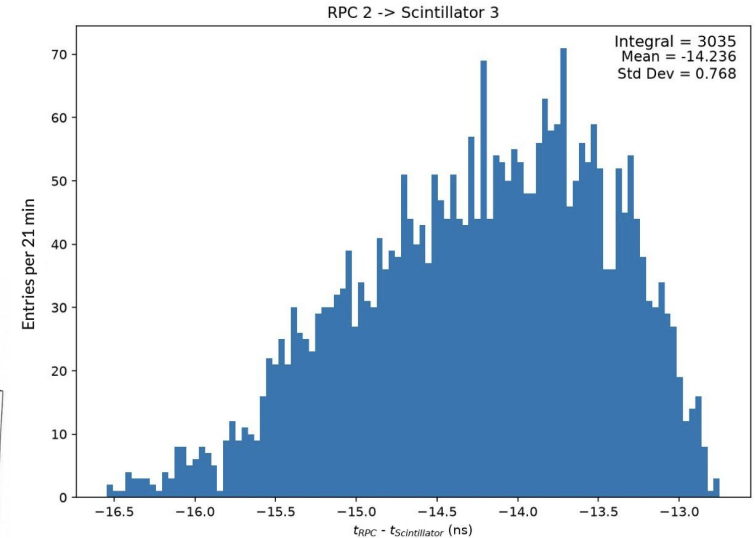
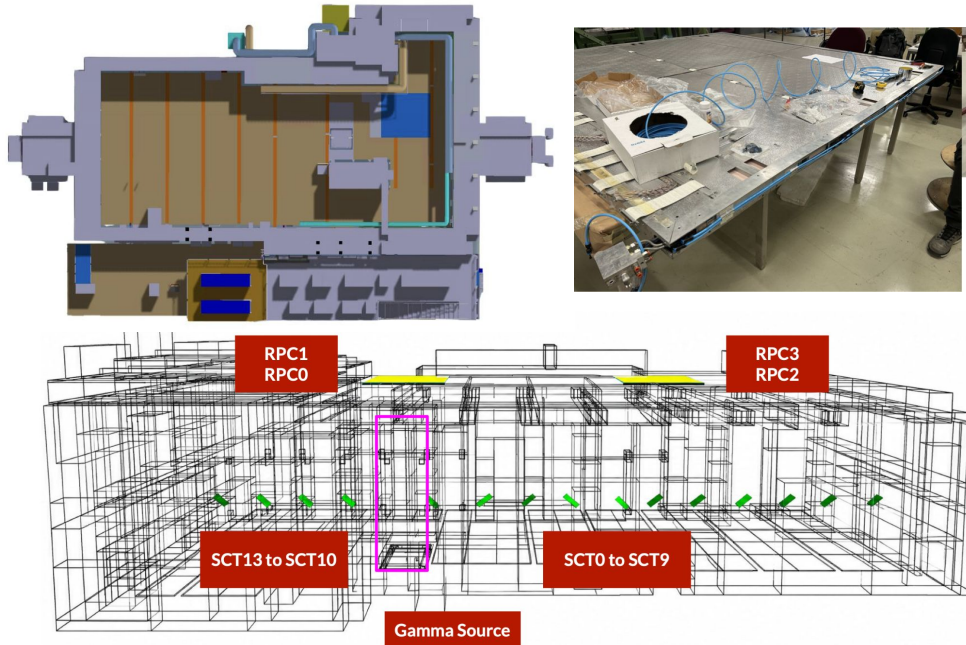
Machine-learning classifiers achieved an AUC of approximately 0.94 in separating signal from secondary hits, reducing the observed system timing spread by 57% and narrowing spatial hit distributions



Applied research and new ideas: **Cosmic-Muon Trigger for CERN GIF++**

Katherine Maslova

Geant4 simulations support a proposed cosmic-muon trigger using reused CMS barrel RPCs and scintillators, with an estimated 140 muons/min in one configuration, enabling detector tests at GIF++ when the SPS beam is unavailable during LS3

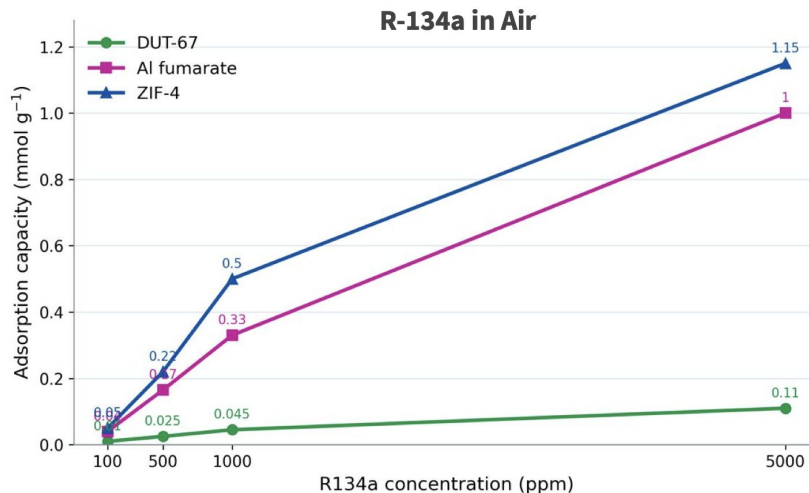
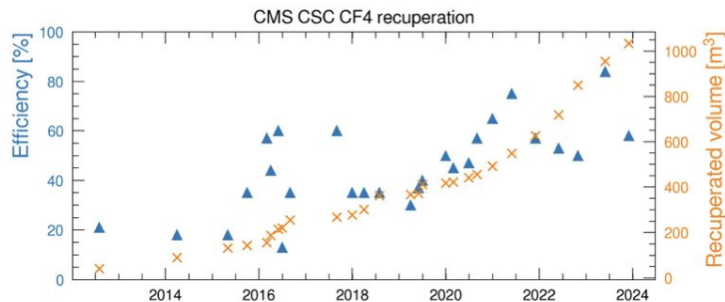
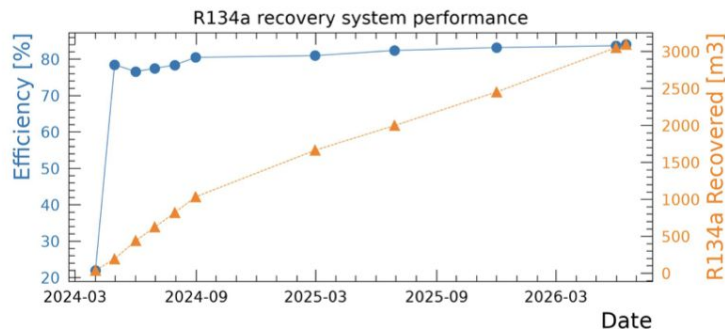


Applied research and new ideas: Reducing Greenhouse-Gas Emissions at CERN

Gianluca Rigoletti



CERN already reduces detector emissions through gas recirculation and recuperation, including up to 80% R-134a recovery from CMS RPC exhaust; emerging membrane and metal-organic framework (MOF) technologies, alongside alternative-gas R&D, offer pathways to further reductions

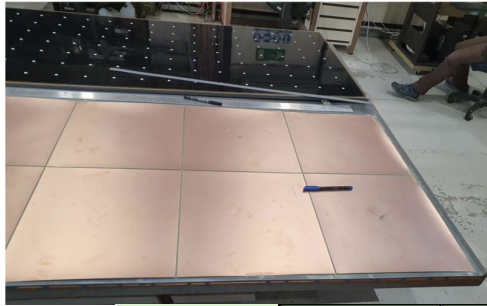


ZIF-4 captures more R-134a from air than other materials

Applied research and new ideas: **A New RPC Signal Readout**

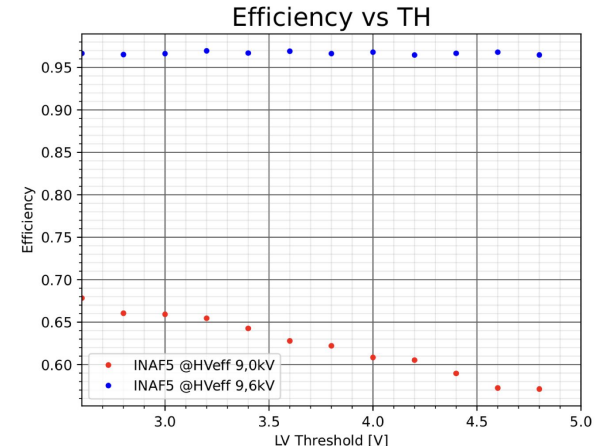
Rinaldo Santonico

To make very large cosmic-ray detectors simpler and more affordable, RPCs with large readout pads, low-cost electronics, integrated high-voltage supplies and improved gas connections are proposed.



Four prototypes tested with cosmic rays achieved $\sim 97\%$ efficiency and ~ 1.3 ns timing, comparable to conventional strip readout; further optimization and on-site tests are planned

Std Dev	4016	4266	3007	3793
Sigma	2352	1905	1729	1742
	2883	2588	2811	2666
pico sec	2281	1792	1973	1663
	2851	2657	2438	2640
	1874	1893	1850	2016
	4068	3645	4625	4186
	1779	1781	2104	1899



Applied research and new ideas

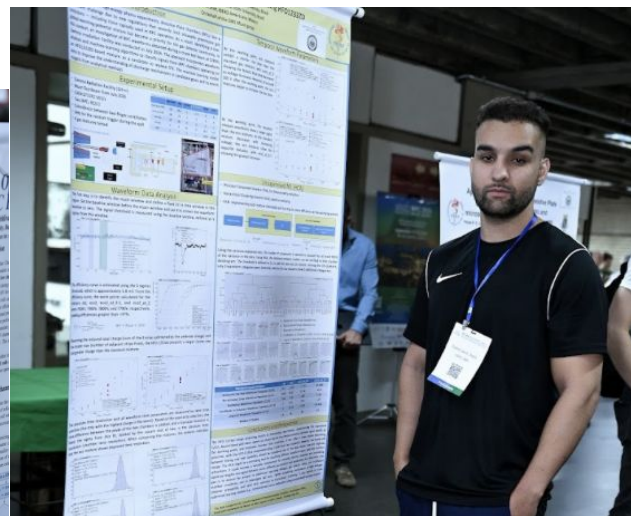
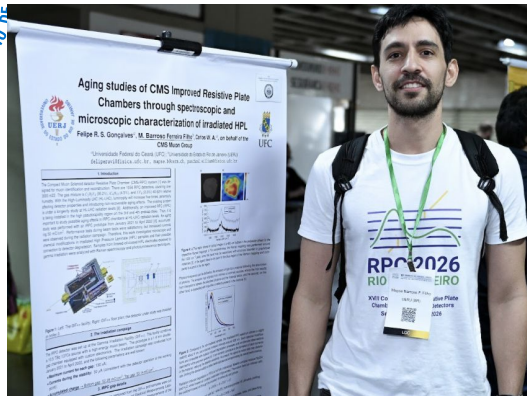


From new detector designs and laser-driven muon-source R&D to machine learning, simpler readout and gas recovery, these studies combine simulations and prototype tests to extend detector capabilities while addressing high-rate performance, cost and sustainability

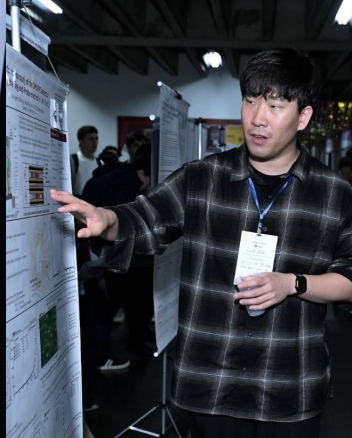
Poster Session



Poster Session



Poster Session



Perspectives

- Maintain reliable RPC operation at the LHC while developing and validating upgrades for future colliders
- Make RPCs more sustainable through leak repair, gas recovery and low-GWP mixtures, without compromising long-term performance
- Turn promising detector concepts into reliable, scalable systems through rigorous testing and quality assurance, opening new opportunities in particle searches, muography and gamma-ray astronomy
- Strengthen knowledge transfer, equip laboratories and expand Global South participation in international R&D and experiment

Building collaborations to carry forward to RPC 2028

Can we call it a success?

